

**Factors Influencing the Acceptance of E-book among  
Mathematics and Statistics Students at Universities in  
Libya**

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**This thesis is presented for the degree of Doctor of Philosophy  
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**Murdoch**  
UNIVERSITY

## **Declaration**

I declare that this thesis is my own account of my research and contains as its main content work that has not previously been submitted for a degree at any tertiary education institution.

**Asma Mohamad Smeda**

*To my mother, my husband, my children, my brothers, my sisters, every member of my family, and particularly to the spirit of my father, with all love and respect.*

## **Abstract**

Although the electronic book (e-book) age has nearly reached four decades, many developing countries, such as Libya, are still struggling to use the e-book in the higher education sector. In ensuring the success of the adoption of the e-book in institutions of higher education in Libya, it is very important to examine the factors affecting the acceptance of the e-book. Therefore, the main objective of this research is to investigate the factors affecting the acceptance of e-book amongst Mathematics and Statistics (MAS) students at universities in Libya. The conceptual model, utilising the Technology Acceptance Model (TAM) model, has been extended by ten external factors.

A quantitative approach was used in this research, where a survey was conducted on students taking Mathematics and Statistics at Libyan universities. The researcher selected three universities accredited by the Ministry of Higher Education in Libya. The sample size was 392 respondents. Structural Equation Modelling (SEM) was utilised to test the predictive behaviour of the selected factors of the research model.

Based on the results obtained in this research, ten hypotheses were accepted, while five hypotheses were rejected. In data analysis process, the Confirmatory Factor Analysis (CFA) is used to improve the developed model validity. Thus the measured variables that have a value lower than the recommended value (lower than 0.5) becomes a candidate for removal (Hair et al., 2010). Therefore, the factor of language has been excluded, and its hypothesis was cancelled. Students' Attitude was the only factor that has a strong direct effect on students' Behavioural Intention. The factors of Perceived Ease Of Use and Perceived Usefulness have an indirect impact on the students' Behavioural Intention through students' Attitude. Moreover, the factors of Self-Efficacy, Social Influence and Facilities also have a significant indirect influence on students' Behavioural Intention via Perceived Ease of Use, Perceived Usefulness and students' Attitude. Furthermore, Perceived Ease of Use considerably influenced the Perceived Usefulness and students' Attitude towards the acceptance of the e-book. Self-Efficacy was the strongest determiner of Perceived Ease of Use; whereas Technical Service had a positive impact on Perceived Ease of Use.



Social Influence and Resistance to Change were significant towards students' Attitude. However, Mobility, Accessibility and Facilities were insignificant toward Perceived Usefulness. Library Service was insignificant upon Perceived Ease of Use, and the Cost was insignificant towards students' Attitude. Finally, in the research model, the results suggest that Resistance to Change is the only factor that has a negative impact on the acceptance of the e-book.

This research confirms that the TAM is a useful theoretical model to understand and interpret students' BI to use e-book, where all of the TAM constructs appear to have a significant impact on the acceptance of e-books among MAS students at universities in Libya. For this reason, there is potential for practical application in the adoption of e-book among MAS students at Libyan universities.

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**In the Name of GOD, the Beneficent, the Merciful**

**All praise is to GOD**

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## **List of Publications and Contributions of the Thesis**

### **Conference Paper**

**C1.** Smeda, A., Shiratuddin, M., & Wong, K. W. (2014). A Proposed framework of the adoption of e-book amongst mathematics and statistics students at universities in Libya. Proceedings SCIECONF (Proceedings of Scientific Conference), 2(1), 6. URL: <http://researchrepository.murdoch.edu.au/22904/>.

**C2.** Smeda, A., Shiratuddin, M., & Wong, K. W. (2015). Perceptions of Mathematics and Statistics Students on the Use of e-book in Universities in Libya. Proceedings SCIECONF (Proceedings of Scientific Conference), 3 (1), 5. URL: [http://www.researchgate.net/publication/278403514\\_Perceptions\\_of\\_Mathematics\\_and\\_Statistics\\_Students\\_on\\_the\\_Use\\_of\\_e-book\\_in\\_Universities\\_in\\_Libya](http://www.researchgate.net/publication/278403514_Perceptions_of_Mathematics_and_Statistics_Students_on_the_Use_of_e-book_in_Universities_in_Libya).

### **Journal Paper**

**J1.** Smeda, A., Shiratuddin, M., & Wong, K. W. (2015). Factors Affecting the e-Book Adoption amongst Mathematics and Statistics Students at Universities in Libya: A Structural Equation Modelling Approach. IJEEEE, 5(4):237-248. doi:10.17706/ijeeee.2015.5.4.237-248. URL: <http://www.ijeeee.org/vol5/384-4E004.pdf>.

**J2.** Smeda, A. M., Shiratuddin, M. F., & Wong, K. W. (2017). Measuring the moderating influence of gender on the acceptance of e-book amongst mathematics and statistics students at universities in Libya. Knowledge Management & E-Learning, 9(2), 177.

**J3.** Smeda, A., Shiratuddin, M.F., Wong, K.W. (2017). A Structural Equation Modelling Approach for Adoption of e-book Amongst Mathematics and Statistics (MAS) Students at Higher Education Institutions in Libya. International Journal of Information and Learning Technology (IJILT), (under review: date of submission for review 31/05/2017).

### Summary of the Contributions of the Thesis

<b>Paper No</b>	<b>Contributions</b>	<b>Chapter</b>
C (1)	This paper addressed the theories of acceptance of technology, research methodology and research framework.	Chapter (1): Introduction Chapter (3): Theories of Technology Acceptance Models Chapter (4): Methodology
C (2)	This paper covered some sections in the literature reviews, such as e-book definition, the advantages of using e-books and challenges of using e-books. Also, this paper addressed some sections of descriptive statistics which have been used to answer question one, such as the demographic profile of the respondents and students' knowledge and actual use of e-books. Moreover, the researcher has used some variables to determine the factors that may encourage or hinder the use of e-books.	Chapter (2): Literature Review Chapter (5): Data analysis and results Chapter (6): Discussion
J (1)	This paper covers four important sections. The first section is the other part of the literature review, which is the “defining some factors of the theoretical model”. The methodology is the next section, which includes the research design and population and sample. The other section includes the explanations of data analysis processes, such as the development and measurement model and proposed hypothesis. The last section is a discussion of the results obtained.	Chapter (4): Methodology Chapter (5): Data analysis and results Chapter (6): Discussion
J (2)	This paper covers another part of literature review which is gender differences and e-book acceptance. Also, it covers the analysis process of the measurement test and the structural model test for multi-group moderation (males and females). Moreover, it explains and discusses the results obtained.	Chapter (2): Methodology Chapter (4): Data analysis and results Chapter (6): Discussion

J (3)	<p>This paper addresses another part of the literature review and theoretical framework which includes the TAM model. It also measures the five additional factors that may affect the adoption of e-books among Mathematics and Statistics students at Universities in Libya. In the methodology section, the Structural Equation Modelling (SEM) process is carried out through two approaches, namely, the measurement model and structural model analysis. The last section explains and discusses the results obtained.</p>	<p>Chapter (3): Theories of Technology Acceptance Models  Chapter (5): Data analysis and results  Chapter (6): Discussion</p>
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## List of Abbreviations

Abbreviations	Description
e-book	Electronic book
MAS	Mathematics and Statistics
AMOS	Analysis of Moment Structures
SPSS	Statistical Package for the Social Sciences
SEM	Structural Equation Modelling
PU	Perceived Usefulness
PEOU	Perceived Ease Of Use of e-book
BI	Behavioural Intention to use e-book
AU	Attitude towards e-book
G	Gender
SI	Social Influence
RC	Resistance to Change
SE	E-reader devices Self-Efficacy
LG	Language
TS	Technical Service Quality
LS	Library Services Quality
AC	Accessibility
C	Cost
M	Mobility
F	Facilities
ICT	Information and Communication Technology
TPB	Theory of Planned Behaviours
TAM	Theory of Acceptance Model
TRA	Theory of Reason Action
IS	Information System
PDF	Portable Document Format
DOC	Document/Documentation (file name extension)
HTML	Hyper Text Markup Language
PDA	Personal Digital Assistant
EFA	Exploratory Factor Analysis
KMO	Kaiser-Meyer-Olkin
CFA	Confirmatory factors analysis
$\chi^2$	The Chi-Square Test
ACFA	Adjusted Goodness-of-fit index
CFI	Comparative Fit Index
GFI	Goodness-of-Fit Index
TLI	Tucker-Lewis Index
SRMR	Standardised Root Mean Ral
RMSEA	Root Mean Square Error of Approximation
CR	Composite reliability
AVE	Average variance extracted
MSE	Maximum Shared Variance
TU	Tripoli University
ZU	Al- Zawia University

GU	Al-Jabal Al-Gharbi University
e-textbook	Electronic version of the textbook

# **1 Chapter One: Introduction**

## **1.0 Overview**

This chapter presents a study of research background. It also deals the research motivation and research problem. The research questions, objectives and the significance of this research have also been addressed in chapter one. Furthermore, it includes the research scope and definition of terms.

## **1.1 Background of the Research**

Due to the advent of technology and its use in many fields such as industry, economy, and communications, it has become an urgent need to integrate technology in the education sector (Duhaney & Zemel, 2000; Rhema, 2013). Technological development has created a boom in the education sector, where the teaching methods have developed and become heavily dependent on the use of technology in developed countries (Anuradha & Usha, 2006; Hashim, 2011). The educational application of computers has evolved from being basic standalone data processing machines in computer labs, to be able to access the Internet, and to where computers are being used in a number of integrated web services that have applications in learning and teaching (Gerry, 2005). The use of Information and Communication Technology (ICT) in teaching and learning, which is commonly referred to as education technology, has quickly grown to become an essential method used in the general delivery of education, especially in developed countries.

As a result of the low level of the human development index, most nations in Africa, Middle East, Southeast Asia, Latin America and parts of southern Europe are classified as developing countries by the United Nations Development Program (UNDP) (Cheibub, 2010; Rhema, 2013). These countries differ in terms of political circumstances, culture, the history of education development, language, gender issues, income resources, the size of population and availability of technology (Gulati, 2008). However, these countries are similar in their need for development and modernization through the use of different types

of technology in all areas (Cheibub, 2010; Rhema, 2013). ICT has variously been described as being an extremely potent force that can drive educational, economic, political and social reforms. It is important for all countries, especially those in the developing stages, to ensure that they do not remain passive to ICT if they want to compete in the larger global economy (Delannoy, 2000). There exists a strong link between the overall health of a country's economy and the quality of education provided by the country to its workforce. There have been widespread global educational reforms, and one of the principal tenets of these reforms is the general integration of ICT in the educational systems of these countries. Therefore, in order for there to be the successful integration of ICT into the various educational institutions, intensive and careful planning on how well various policymakers essentially appreciate and understand the overall dynamics will have to be involved (Jhurree, 2005).

It is critical for developing countries to ensure that they emulate the integration of ICT into the education sector that has been achieved by developed countries. A good example of this emulation can be seen in the case of Brazil and India (Agarwal, 2006). One of the key attributes of the impact of ICT on learning is that learning is essentially not constrained by any geographical proximity and can occur anyhow, anywhere and at any time. ICT is also seen to equip learning with a number of various possibilities such as increased and better possibilities for archiving, sharing and retrieving knowledge. ICT is seen to have the added potential of being able to not only improve the management efficiencies of an educational system but also to widen the access to various educational resources (in addition to contributing to vastly improving the quality of learning) (Butcher, 2011).

Libya, like most developing countries, is still struggling to integrate ICT in the education sector (Rhema & Miliszewska, 2011; Rhema, 2013; Benghet & Helfert, 2014). The adoption of ICT in education in Libya is relatively in a nascent stage due to a low level of basic computer skills among the educated in most of the institutions of higher education in Libya, as well as the lack of educational technology awareness in general (Rhema & Miliszewska, 2010; Rhema, 2013). Although most of the institutions of higher education in Libya have the fundamental infrastructure of ICT such as labs of computers, local area



network and the service of Internet access, they are still using traditional methods of learning (Rhema, 2013).

The Libyan government realises that the education of any society should be perceived as being the most effective tool that can be employed in the transformation of a given country's economy (Giroux, 2006). This is because a well-educated workforce is an integral factor in the maintenance and development of a country (Giroux, 2006). Therefore, The General People's Committee of Education (2008) confirmed that the Libyan government had started serious steps to modernise and improve the education system, through the application of national programs, for the integration of ICT in education, especially in the higher education sector. The goal of the national policy for ICT is to develop the ability of Libya to access the ICT, the provision of infrastructure and tools of ICT and assist in the development of ICT skills to include all the sectors of society (Hamdy, 2007; Rhema, 2013). Decision makers in Libya are convinced that the use of electronic education in Libya will provide the opportunity to restructure the education system in Libya, especially that of the higher education sector, as well as the development of teaching methods used (Rhema, 2013).

Based on the previous discussion, electronic education can be presented as the utilisation of ICT in the learning process (Ashwin, 2005; Laurillard, 2006). Electronic education is found to have a number of different educational and interactive applications that are able to support a wide variety of different types of applications, such as using the electronic book (e-book). Some of these include the use in the design of digital virtual learning environments that can aid in the manipulation and development of data analysis, through internet search access and transactional services. Moreover, it can provide access to a large variety of materials that might not be locally available, as well as offer remote control access to several various physical devices. Indeed, it can provide a variety of organisational and modelling tools, interactive educational games, electronic devices and applications that can help assist disabled learners as adaptive or diagnostic tutorials (adaptive teaching is an educational method which uses computers as interactive teaching devices, and to orchestrate the allocation of human and mediated resources according to the

unique needs of each learner). Also, it has applications in organisational and modelling tools, and it can serve to support both the models and simulations of various scientific communication tools (Ashwin, 2005; Laurillard, 2006).

The e-book is becoming more widespread in developed countries due to its dynamic features and nature of mobility. As of this writing, electronic publications have overtaken printed versions as a source of information and news for the majority of readers in the United States (Anderson & Fathi, 2004; Kelley, 2011; Rosenstiel & Mitchell, 2011). Many studies involving the adoption of the e-book in education claim that they are widely used in developed countries (Kropman, Schoch, & Teoh, 2004; Embong *et al.*, 2012a). However, most developing countries such as Brazil, Indonesia, Singapore, Turkey and Libya are still struggling to use the e-book as part of enhancing their education system (Noorhidawati & Gibb, 2008; Embong *et al.*, 2012a; Roesnita & Zainab, 2013). In the Arab society, such as Libya, the e-book cannot compete with the printed book, at least at the moment. The Arab experience is still at the beginning of the road (Malkawi, 2012). Recently, e-books already started spreading in the Arab society, and they have occupied a good position among the new generation of young people, especially after the emergence of smart mobile devices. However, its use in academic study is still very limited (Malkawi, 2012).

The e-book is defined by Khanh and Gim (2014); (Park & Kim, 2014) as a digital representation of printed material presented via electronic devices or mediums that include e-book readers, personal computers, smartphones, netbook, PDAs and tablets. The content of the e-book would comprise of books, journals, research, reports and magazines. Most e-books have features such as note taking, interactive tools, highlighting, bookmarking, hypertext links, searching, multimedia objects and annotating (Vassiliou & Rowley, 2008; Sieche, Krey, & Bastiaens, 2013).

In recent times, most educational institutions are working to transform their learning paradigms from the use of printed materials, such as textbooks, to the use of electronic sources, such as e-books. This technology allows for universities to widen their educational territories outside of time and place and beyond the promotion of traditional

learning too. Most students and teachers, as well as librarians, advocate for the use of e-books for studies, citing the many benefits that are derived from that method of learning (Educause Learning Initiative, 2006; Pastore, 2008; Embong *et al.*, 2012b). The benefits are the fact that it is relatively cheap, as well as the availability of variety. Besides these benefits, the ease of learning and the experience in using e-materials is excellent due to the multimedia features that are basic accompaniments of e-materials. This, therefore, provides a new dimension in learning for people who fancy reading through diversity and may provide new learning experiences to aid learning for persons who find learning challenging. Furthermore, it is easy to present feedback to authors and recommend possible changes to the learning materials (Educause Learning Initiative, 2006; Pastore, 2008; Embong *et al.*, 2012b).

Although there is a rich and rapidly growing body of literature on e-books, the research focusing on the acceptance of the e-book is still limited (Letchumanan & Tarmizi, 2011a; Jin, 2014). Most of the studies on e-books' acceptance have been carried out in developed countries (i.e., USA, UK and Canada), where the focus is on the study of the perception of real users and their intention to use the e-book (Anuradha & Usha, 2006; Levine-Clark, 2006; Woody, Daniel, & Baker, 2010; Letchumanan & Tarmizi, 2011a; Letchumanan & Muniandy, 2013). Despite the fact that the e-book is nearly four decades old, developing nations are still struggling to use the e-book (i.e., Turkey, Brazil, Indonesia and Libya) (Sim *et al.*, 2014). A few studies on the use of e-books have been conducted in developing countries, most of them are in-depth studies and suffer from a lack of statistical evidence. There are many factors that impact on the use of the e-book, especially in those countries that are still in the early stages of using the e-book (Spring, 2010; Williams, 2011). Both intrinsic and extrinsic factors play a large role in the adoption of the e-book in developing countries (Smeda, Shiratuddin, & Wong, 2015a). The more prominent extrinsic factors that can have a significant impact on the acceptance of e-book in these countries are the cost, technical service, library service and accessibility (Margaret & Sarah, 2014). Moreover, the intrinsic factors related to the real users or non-users must be taken into account as well (i.e. self-efficacy, resistance to change and language). This research has

covered this gap, where many factors are subjected to the study in one of the developing countries, namely Libya.

## **1.2 Research Motivation**

As in the case of most developing countries, the applications of ICT are still in its early stages in Libya (Rhema, 2013; Benghet & Helfert, 2014). Also, the level of technological awareness and computer skills are still very low among educated people in institutions of higher education that lead to the lack of the adoption of ICT in education (Rhema, 2013). Although most Libyan universities have the infrastructure for basic ICT (computer labs, access to the Internet and a local area network), they are still not able to take full advantage of the technology (Rhema, 2013). In 2008, the Libyan government began serious steps towards the investment in the development of the education system through the development of plans to introduce ICT in education (The General People's Committee for Education, 2008). This policy is aimed at the use of ICT in education, where the focus is on the establishment of infrastructure, to provide ICT tools, work to develop Libya's ability to enable ICT access and offer assistance to widely developing the skills of ICT in different sectors (Hamdy, 2007; Rhema, 2013). Therefore, such efforts should be reinforced by the necessary research that would help decision-makers in the Libyan state to make the necessary decisions in this field.

Currently, efforts are being made in developing countries in order to use e-books in higher education institutions (Rhema, 2013). Therefore, the Libyan government has started to think seriously about supporting the use of e-books as an option to improve the quality of the education system (Kissinger, 2011). The increase in modern technology in the consumer market, such as growth in the availability of electronic texts on the Internet and the emergence of modern electronic devices that can be used as e-book readers, can be an important reason. Furthermore, the increase in the price of printed publications such as textbooks and scientific publications has led to the growing burden of the overall costs for students attending university (Kissinger, 2011). Therefore, the Libyan government is calling for the modernization of the higher education sector by utilizing technology (Hamdy, 2007) and some tertiary institutions are considering a move to use e-books (i.e.

electronic textbooks) as an option to ensure that their students will receive a high level of educational attainment (Alchukhucka, 2006; Azza, 2011)

. Thus, it is important to understand the factors that influence students' behavioural intention to use e-books at higher education institutions in Libya. This understanding is often a prerequisite crucial to develop effective strategies aimed at increasing the level of use of new information technologies systems such as e-books (Gu, Lee, & Suh, 2009; Tsai & Li, 2011).

Although there is a rich and rapidly growing body of literature on e-books, the research that focuses on the acceptance of e-book is limited (Letchumanan & Tarmizi, 2011a; Jin, 2014). Most previous studies on the acceptance of e-books have been executed in developed countries (Shepperd, Grace, & Koch, 2008; Chong, Lim, & Ling, 2009; Knutson & Fowler, 2009; Nariani, 2009; Slater, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; de Oliveira, 2012; Roesnita & Zainab, 2013; Wiese & Du Plessis, 2014). These studies have focused on the investigation of the perceptions and experiences of the real users of e-books and their opinions about continuing to use it in the future (Chang, Yan, & Tseng, 2012; Lee, 2013; Letchumanan & Muniandy, 2013). Besides the real users, this research also focuses on non-users in Libya, a developing country. The researcher hopes to provide a platform for non-users to take advantage of this innovation. In Libya, few studies have been conducted on the topic of the use of the e-book in education (Azza, 2011; Elkameshi, 2012). The main limitation of these studies is that they failed to account for the experiences and perceptions of students with respect to the use of the e-book. Moreover, the studies neglected to identify the factors that may pose as an obstacle to the utilisation of e-books in some cases or may constitute an attraction for the use of an e-book at other times.

Many past studies have found that there is a rather slow adoption of the e-book as compared with the emerging trends in the use of technology within various disciplines of use (Wilson, 2001; Chong *et al.*, 2009; Smeda, Shiratuddin, & Wong, 2015b). It has been projected that there would be a higher rate of approval by now, although that is different from what is actually witnessed. Several studies have been done regarding e-books in

different disciplines (Borgman, 2010; Tan, 2009). According to Letchumanan and Tarmizi (2010), the rate of using e-books by Mathematics and Statistics (MAS) students in Malaysia is relatively low. Moreover, the statistics provided by some publishers such as Springer have shown that the acceptance rate of e-books among MAS students is very low, as compared to other students in other disciplines. In 2009, the students' access ratio (Wilson) for the Mathematics e-books published by Springer was only 50 Mathematics titles. However, the access ratio of Engineering students (also at Universiti Putra Malaysia) for Engineering e-books published by Springer is 129 Engineering titles (Letchumanan & Tarmizi, 2010). Therefore, this research focuses on MAS students at universities in Libya as the population. The reason being, it is still unclear as to what factors encourage or hinder them to adopt this technology in their education process and to what extent will MAS students accept the use of e-books.

The impact of gender differences becomes a source of concern for many researchers in the acceptance of the e-book (Maduku, 2015b). Nevertheless, there are only a few studies that have focused on researching into the effects of gender differences on the acceptance of e-books in developing countries such as South Africa (Maduku, 2015b); as most studies have been conducted in developed countries (Letchumanan & Tarmizi, 2011a; Ngafeeson, 2011; Marston, Thrasher, & Ciampa, 2014; Yoo, Huang, & Kwon, 2015). To meet the aspirations of developing countries in adopting e-books, the need for research that examines the effects of gender on the use of the e-book has become urgent.

The effect of gender differences should be considered to demonstrate whether the differences really exist between the genders in the environment being studied. The study of the effect of gender differences has become essential, especially in countries that separate males from females in most educational institutions, such as some Arabic countries (Al-Aulamie, 2013). There are currently no studies investigating the effect of gender differences on students' behavioural intention to use e-books in Libya. As there is a gap in our understanding of this issue, it should, therefore, be covered by any plans to adopt the e-book in the higher education sector in Libya are made. Thus, this research

seeks to clarify this ambiguity and investigate the effects of gender on students' behavioural intention to use e-books in the higher education sector in Libya.

Many studies that have used the Technology Acceptance Model (TAM) to explain students' behaviour towards the use of e-books have been limited and focus mostly in Europe, North America and the Far East (i.e. Malaysia and Korea). Moreover, the results of these studies are not applicable in Libya. Saadé, Tan, and Nebebe (2008) point out that culture has an important impact on the research results (Al-Aulamie, 2013). Therefore, the dissemination of research findings from one culture to another will not be applicable because of the cultural differences among the users (Al-Aulamie, 2013). Nevertheless, these research results can be used as an indication that requires necessary checks and confirmation on a group of new users (Al-Aulamie, 2013). This also encourages us to continue the investigation for the acceptance of e-books among students in Libya. In addition, this could help in the understanding of the potential factors that may impact on the acceptance by Libyan students. However, there are many evidence that the differences of culture may be responsible for some variations in the results of the TAM (Sánchez-Franco, Martínez-López, & Martín-Velicia, 2009; Tarhini *et al.*, 2016). The TAM may be not applicable across all cultures, and therefore, its importance lies in the testing in the Arab context.

Structural Equation Modelling (SEM) is a powerful statistical modelling technique which is widely used in sciences that require sophisticated statistical analyses. Most of the previous studies in the field of e-book acceptance have used the traditional methods (i.e. regression, correlation and analysis of variance). Although the similarities between traditional methods and SEM lie on several points, SEM often outperforms these models making it widely used in the fields of human, medical and applied sciences (Schumacker & Lomax, 2004; Bollen, 2014). For example, both methods depend on linear statistical models. Also, statistical tests related to both methods are correct, if certain assumptions are met (Suhr, 2006a). However, there are many features that distinguish SEM from traditional methods, and this variance has prompted the researcher to use SEM technique (Suhr, 2006a). First, SEM is characterised by a high degree of flexibility and a

comprehensive methodology that may be lost in traditional methods (Suhr, 2006a). Moreover, SEM requires a certain specification of the model to be estimated and examined, while traditional methods determine the default model. SEM is also used to support the hypotheses of the research and to identify the relationships in advance (Suhr, 2006a). Also, SEM is a multivariate method which integrates the observed variables (measuring) and unobserved variables (latent constructs); whereas traditional methods only measure observed variables (Suhr, 2008). In addition, SEM allows the researcher to determine the measurement error precisely, while traditional methods assume the occurrence of the measurements without error (Golob, 2003). Unlike traditional methods, SEM strategy is not straightforward tests to identify the fit of the model. Instead, the study of multiple tests is the best strategy to assess the model fit (i.e. Goodness-of-fit Index (GFI), Adjusted Goodness-of-Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA), Comparatives Fit Index (CFI), Standardised Root Mean Residual (SRMR) and Tucker-Lewis Index (TLI)) (Golob, 2003). Finally, graphic language provides a convenient and effective way of understanding and representing complex relationships in SEM. Diagrams are converted into a set of equations that solve simultaneously to measure the model fit and estimate the model parameters (Suhr, 2006a).

### **1.3 Research Problem**

According to Letchumanan and Tarmizi (2011a); Jin (2014), there are very little studies in the field of the acceptance of the e-book in general. Most of these studies are concentrated in developed countries. The paucity of studies looking at the acceptance of the e-book among higher education students in developing countries, specifically in Libya, is the motivation behind the creation of this research. Libya, like other developing countries, still suffers from a lack of computer knowledge and experience for the faculties and students of higher learning institutions. Most undergraduates in Libya do not have the knowledge and sufficient experience on how to obtain an e-book and use it; even those who have some skills use it for leisure and not for the purpose of education (Smeda et al., 2015a). As a result of the lack of studies designed to identify students' knowledge and experiences on the use of the e-book in Libya, this research arose to cover this gap. This



research examines the MAS students' knowledge and experiences about the use of the e-book at universities in Libya. A quantitative approach was utilised in the present research. The sample size was 392 participants, namely MAS students at universities in Libya. The Statistical Package for the Social Sciences (SPSS 21) was used to analyze the data. Descriptive statistics were used to calculate the demographic data and students' experience.

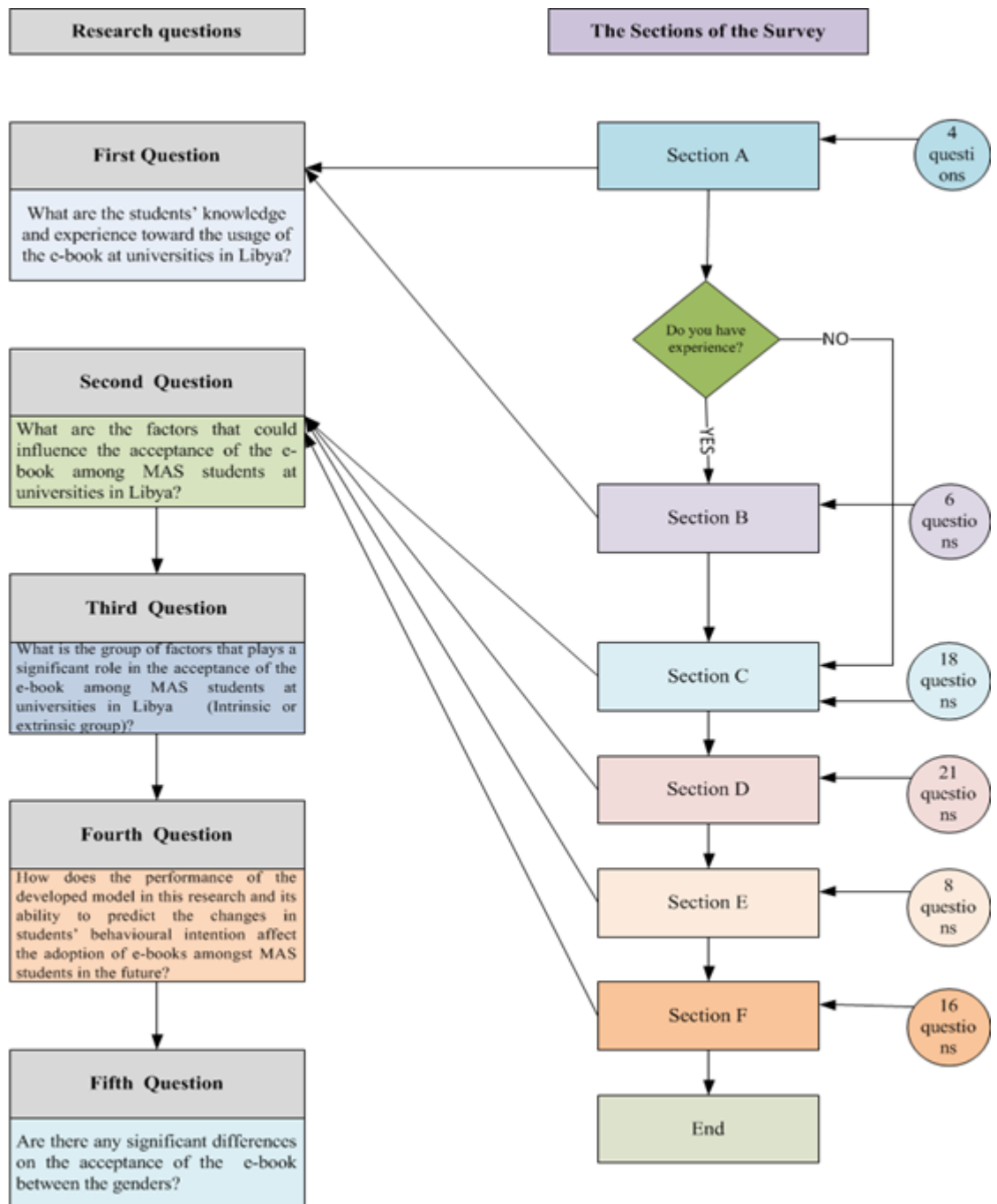
Despite the boom that occurred as a result of the use of technology in the field of education, developing countries are still facing many challenges in the area of using the e-book (Noorhidawati & Gibb, 2008; Embong *et al.*, 2012a; Roesnita & Zainab, 2013). Despite the widespread importance of behavioural intentions in students' practices, there is a paucity of research focused on the factors that influence behavioural intent towards the use of e-book (Jung *et al.*, 2012; Maduku, 2015a). Thus, it prompted an urgent need to conduct extensive studies in this area, especially those related to studying the factors that influence the adoption of the e-book. Libya is one of the developing countries that are still struggling to adopt the e-book in the higher education sector (Alchukhucka, 2006; Azza, 2011; Smeda *et al.*, 2015b). The factors that affect the use of the e-book are still unknown to the present day (Smeda *et al.*, 2015a). Therefore, the main objective of this research is to investigate the factors that may affect the acceptance of the e-book among MAS students at higher education institutions in Libya. It can also be utilised to predict students' behaviour on the use of e-books in Libya in the future. Structural Equation Modelling (SEM 22) is used to measure the theoretical model and examine the hypotheses. The research hypotheses are examined by path analysis using the Standardised Coefficient, Probability Value and Critical Ratio.

According to previous studies in the e-book field, gender has become a significant issue for researchers to understand the acceptance of the e-book (Maduku, 2015b). The impact of gender differences should be taken into account to prove whether the differences really exist between the genders in the study environment. As a result of the lack of understanding of this particular aspect in Libya, this research has investigated the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books among the MAS students at universities in Libya. The measurement and structural model

were checked by using SEM. First, the measurement model was tested for differences between the genders in terms of the measured variables. In addition, the structural model was also tested for differences between the genders in term of the hypotheses. In the Analysis of Moment Structures (AMOS), multi-group analysis classifies data on the basis of the value of grouping (i.e. gender), and the group analyses are performed simultaneously among males and females (Byrne, 2013).

#### **1.4 Research Questions**

Libya, like other developing countries, suffers from the scarcity of scientific research in the field of technology including the e-book (Hamdy, 2007; Rhema, 2013; Smeda, Shiratuddin, & Wong, 2014), especially those studies that are established on scientific grounds and are reliable statistical studies (Tashani, 2009). Therefore, the answer to the questions posed by this research may contribute to set the foundation stone for studies that seek to develop the use of the e-book in Libya. There are many questions that need to be asked, and satisfactory answers need to be found, in order to achieve the research goals. Five questions have been raised to create a broad study on the use of the e-book in Libya. Figure 1.1 shows the research questions and the questionnaire sections that are used to resolve them. It also illustrates the number of questions answered by participants in each group.



**Figure 1.1: The Research Questions and How They are Resolved through the Questions of the Survey**

**1. What are the students' knowledge and experience towards the usage of the e-book among MAS students at universities in Libya?**

This question is divided into two parts: the first part addresses students' knowledge about the e-book. The second part includes students' experiences on the use of the e-book, such as the rate of using the e-book, students' familiarity with the e-book, the device that is usually used to read the e-book, the purposes of using the e-book and the perspective of students on the use of the e-book in the future.

**2. What are the factors that could influence the acceptance of the e-book among MAS students at universities in Libya?**

The TAM model is extended by adding ten factors. The external factors are selected based on the study of the literature. Sixteen hypotheses are subjected to testing to determine the factors that have an effect on the acceptance of the e-book among MAS students at universities in Libya. The hypotheses collected between the external factors and the TAM constructs are as follows:

**H1:** Mobility has an influence on MAS students' Perceived Usefulness of the adoption of the e-book at universities in Libya.

**H2:** Accessibility has an influence on MAS students' Perceived Usefulness of the adoption of the e-book at universities in Libya.

**H3:** Facilities have an influence on the Perceived Usefulness of the e-book among MAS students at universities in Libya.

**H4:** Facilities have an influence on the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H5:** The Cost has an influence on MAS students' Attitude towards using the e-book at universities in Libya.

**H6:** The Library Services Quality influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H7:** Technical Service Quality influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H8:** Social Influence has an influence on MAS students' Attitude towards using the e-book at universities in Libya.

**H9:** Language influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H10:** Self-Efficacy influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H11:** Self-Efficacy influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H12:** Resistance to Change influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H13:** Perceived Ease Of Use influences the Perceived Usefulness of the e-book among MAS students at universities in Libya.

**H14:** Perceived Ease Of Use influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H15:** Perceived Usefulness influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H16:** Attitude influences MAS students' Behavioural Intention to adopt the e-book at universities in Libya.

**3. What is the group of factors that plays a significant role in the acceptance of the e-book among MAS students at universities in Libya (intrinsic or extrinsic group)?**

In this research, the external factors are divided into two groups, Intrinsic or extrinsic. This question includes a comparison between the two groups of factors (intrinsic or extrinsic) to determine the role of each group in the acceptance of the e-book.

**4. How does the performance of the developed model in this research and its ability to predict the changes in students' behavioural intention affect the adoption of the e-book amongst MAS students in the future?**

After developing and testing the theoretical model, the path diagram is translated into a series of linear equations that can be used to predict students' behavioural intention to use e-books in higher education institutions in Libya. The coefficient of determination ( $R^2$ ) is the most significant criteria that used in the statistical analysis to assess the model's ability to explain and predict future results. It is also used as a guide to measure the accuracy of the model.

**5. Are there any significant differences in the acceptance of the e-book between the genders?**

This research also investigates moderating the impact of gender on the relationships among the factors affecting the acceptance of the e-book among MAS students at universities in Libya. It provides a better understanding of e-book acceptance between male and female students taking Mathematics and Statistics at universities in Libya.

## **1.5 Research Objectives**

The main objectives of this research are:

1. To identify the knowledge and experience of MAS students on the perception and adoption of the e-book at universities in Libya.
2. To investigate the factors affecting the acceptance of the e-book amongst MAS students at universities in Libya.
3. To investigate which group of variables plays a significant role in the acceptance of the e-book (intrinsic or extrinsic factors).
4. To develop the theoretical model to derive a mathematical relationship to predict MAS students' behavioural intention to use the e-book at universities in Libya in the future.

5. To investigate the moderating impacts of gender towards students' acceptance of the e-book. The research will explore if males and females have different perceptions towards the e-book.

## **1.6 Significance of the Research**

Chuntao (2010) argues that the boom which has occurred in education, particularly in higher education, is a result of the use of modern technology in education. Currently, the growth of the use of education technology (e-learning) in developing countries is something remarkable (Rhema, 2013). This growth is the result of a number of research carried out to investigate the factors that may support or hinder the use of education technology in various developing countries like Egypt, Saudi Arabia, Nigeria and Tanzania (Sife, Lwoga, & Sanga, 2007; Ajadi, Salawu, & Adeoye, 2008; Al-Aulamie, 2013; Rhema, 2013). Libya, as one of the many developing countries, aspires to develop the sector of higher education through the use of ICT (Hamdy, 2007; Rhema & Miliszewska, 2010; Tamtam *et al.*, 2011; Rhema & Miliszewska, 2012; Rhema, 2013). An e-book is one of the ICT that uses the technology of computer to deliver multimedia information in the form of a compact and dynamic. Although the e-book age has nearly reached four-decade, there is very little literature in the field of the acceptance of the e-book especially in developing countries (Jin, 2014). As such, this research could support the efforts to promote this sector.

Considering the recent crises experienced by Libya, as a result of armed conflict and political crisis (which has caused the destruction of both the infrastructure and even psychological destruction of individuals), it is necessary to restructure the education system in Libya and focus on its reconstruction and development (Rhema & Miliszewska, 2012). The use of ICT in education can play a crucial role at this stage. ICT is an essential element of a global response to the crisis, whether natural or man-made (Rhema & Miliszewska, 2012). According to Rhema (2013), ICTs are essential elements of the coordination mechanisms that educational organisations need to regain, in order to help the affected learners and teachers. For Libya, like other developing countries, the use of ICT

including e-book in education is still in the early stages, even before the outbreak of armed conflict (Rhema, 2013). Although the recent crisis has led to a setback in the electronic outreach efforts in Libya, conducting research in this area can help to spread the use of ICT including e-book to support and develop the education sector in Libya.

This research is one of the unique studies of its kind to be held in Libya, to deal with the factors that influence the adoption of e-books among higher education students in general. To deepen the study and make the results more useful, the researcher has focused on MAS students as representing the smallest group amongst the states which uses e-books. Therefore, this research will enhance the limited body of knowledge and serve as a key reference for the adoption of the e-book in Libya.

An understanding of the acceptance of the e-book is often a prerequisite crucial to developing effective strategies aimed at increasing the level of the use of e-books. This research can be used as the source of information for academics, decision makers, as well as the administrators concerned with the general implementation of the e-book in Libya. The recommendations offered in this research will facilitate decision making among academics in Libya, where they can establish strategies to incorporate the use of e-books in their educational institutions.

The results of this research could also help the faculties of MAS in Libya understand the current state of e-books, which can help improve their attitudes towards the use of the e-book as a new method of teaching and learning. Faculty members could also acquire knowledge from the results of this research to help them understand students' tendencies through knowledge of the barriers and incentives facing the use of the e-book by students.

Studying the effect of gender on the acceptance of the e-book can help researchers who are interested in studying the impact of demographic factors on the use of technology; where the impact of gender is still a subject of controversy among many researchers, especially in the Arab countries. E-books are becoming increasingly important in the society in general and for higher education students in particular, especially after the rapid growth of portable electronic devices that are used to read e-books. Nevertheless, there



have been limited studies on the effectiveness and acceptance of the e-book in the higher education sector in developing countries so far. Thus, this research provides a thorough review of the literature on the acceptance and effectiveness of the e-book in developing countries in general and the Arab world in particular.

In addition, university libraries can benefit from the results of this research to develop the services that they provide to students by an awareness of the reasons that hinder the use of the e-book. It also provides the managers of the libraries a better understanding of the method in which they can support students.

The theoretical model that is developed in the present research could be used to build mathematical equations. These equations can be used to predict the acceptance of the e-book among MAS students in future, provided they are used in the same environment in which the study was conducted.

The results of this research can also be used primarily as a critical nucleus that will assist other future researchers on the subject matter in Libya because there has been no previous research conducted in Libya.

Moreover, numerous past studies about e-books have been carried out in developed countries. These studies have focused on the investigation of the perceptions and experiences of real users of the e-book and the possibility of continuing to use it in the future. Besides the real users, this research also focuses on non-users of the e-book in Libya. The researcher hopes to provide a platform for potential users or non-users to take advantage of this innovation.

Overall, the results of this research do not only provide useful guidelines for the improvement and promotion of the acceptance of the e-book in Libya but are considered a significant contribution to the existing body of literature on e-book acceptance, especially in developing countries.

## 1.7 Research Scope

1. Recently, many researchers have focused on the role that technology plays in the development of the educational process and specifically, in the factors determining technology adoption and usage. Many models have been developed to aid in predicting technology acceptance. Therefore, this research will enhance the TAM by adding several external factors to examine students' acceptance of the e-book, specifically amongst MAS students at universities in Libya.
2. There are many reasons that prompted the researcher to study the effect of gender on the acceptance of the technology. Firstly, according to Padilla-Meléndez, del Aguila-Obra, and Garrido-Moreno (2013) and Terzis and Economides (2011), gender has become an important issue that affects the understanding and identification of user acceptance of Information Technology (IT). Venkatesh and Bala (2008) have also proved that gender has an impact on users' acceptance of IT. Therefore, gender should be checked to illustrate whether differences exist between the sexes in the environment that is being investigated. Another reason is related to the Libyan culture. Libya, as an Arabic country, is conservative as males and females are separated in their daily lives (Al-Alamia, 2013). However, they are studying together in most stages of their studies, but they avoid any debate or studying in a group at the university stage.
3. The focus of this research is Mathematics and Statistics (MAS) students and the outcomes obtained in this research are based on the data collected by a self-administered survey. The questionnaire was designed to suit MAS students; however, the results will determine if this questionnaire can also be used with students in other disciplines and whether the results can be generalised.
4. The research objective focuses on undergraduate students within Libyan universities. The present researcher has selected this group because most of the

Libyan universities' population consists of undergraduate students. The small group of postgraduate students in the MAS school makes it hard to carry out the statistical analysis on this sector. Therefore, the questionnaire will be targeted to undergraduates for both genders.

## 1.8 Definition of Terms

This section will deal with an explanation of each variable that will be used in this research. Table 1.1 provides a definition of the factors used to develop the research model. These factors were divided into three groups. The first group contains the TAM constructs, which are PU, PEOU, AU and BI. Secondly, the extrinsic factors group includes all factors related to the characteristics of the e-book, infrastructure of the university and social factors like TS, LS, AC, C, M, F and the effect of the SI. The third is the intrinsic factors group, which includes all factors relevant to the current and potential users, such as RC, SE and L.

**Table 1.1: Definition of the Factors**

Group	Factor	Definition	Reference	Questionnaire variables of Factors
<b>TAM Constructs</b>	Perceived Usefulness of the e-book (PU)	The degree to which a student thinks that the use of the e-book in education will have great benefits and provide positive outcomes.	(Venkatesh & Davis, 2000)	PU1 PU2 PU3 PU4 PU5
	Perceived Ease Of Use of the e-book (PEOU)	The degree to which a student thinks that the use of the e-book will take less effort.	(Venkatesh & Davis, 2000)	PEOU1 PEOU2 PEOU3 PEOU4
	Attitude towards the e-book (AU)	Positive or negative feelings about the use of the e-book.	(Venkatesh et al., 2003)	AU1 AU2 AU3 AU4 AU5

Group	Factor	Definition	Reference	Questionnaire variables of Factors
	Behavioural Intention to use the e-book (BI)	The degree to which a student has formulated conscious plans to perform or not perform some specified future behaviour.	(Venkatesh et al., 2003)	BI1 BI2 BI3 BI4
<b>Extrinsic Factors</b>	Technical Service Quality (TS)	The level of the necessary Information and Communication Technology (ICT) provided by the university to support the education process.	(Abbad <i>et al.</i> , 2009b)	TS1 TS2 TS3 TS4
	Library Services Quality (LS)	The quality of services provided by the library to students and teachers.	(Perry, 2005)	LS1 LS2 LS3
	Accessibility (AC)	The degree to which the e-book is available to as many students and teachers as possible. Also, it can be viewed as the "ability to access" and benefit from some of the services.	(Wixom & Todd, 2005)	AC1 AC2 AC3
	Cost (C)	The amount of money that has been paid to buy the e-book. This includes the electronic reading devices such as handheld devices, software used and electronic publications.	(Kurnia, Smith, & Lee, 2006)	C1 C2 C3
	Mobility (M)	This means that the advantages and disadvantages of mobile devices that are used for e-book reading.	(Walton, 2013)	M1 M2 M3

Group	Factor	Definition	Reference	Questionnaire variables of Factors
	Facilities (F)	Facilities are the use of the tools and functions of the e-book to clarify the contents of the e-book for users.	(Mustafa, Harun, & Endin, 2014; Smeda <i>et al.</i> , 2014)	F1 F2 F3 F4
	Social Influence (SI)	The extent to which you are influenced by the behaviour of others.	(Fishbein & Ajzen, 1975)	SI1 SI2 SI3 SI4
<b>Intrinsic Factors</b>	Resistance to Change (RC)	The reasons behind the resistance to change.	(Berbaoui Kamel, 2012)	RC1 RC2 RC3 RC4 RC5 RC6 RC7 RC8
	Self-Efficacy (SE)	The degree to which an individual believes that he or she has the ability to perform a specific job/task using the e-book.	(Compeau & Higgins, 1995; Compeau, Higgins, & Huff, 1999; Al-Ammari & Hamad, 2008; Abbad <i>et al.</i> , 2009b)	SE1 SE2 SE3 SE4
	Language (LG)	The level of English language used in education.	(Ali & Magalhaes, 2008)	LG1 LG2 LG3 LG4 LG5

## 1.9 Outline of the Thesis

**Chapter One** addresses the research background, research motivation and the problems of the research. It also discusses the research questions. The research aims, objectives and

significances are also explained in this chapter. Moreover, this chapter includes the research scope, limitations and definitions of research variables.

**Chapter Two** discusses the education and technology theories. It also reviews the use of ICT in higher education, specifically in Libya. Also, the ICT policy that has been adopted by the Libyan government is explained. The challenges facing the adoption of technology in the education sector in Libya is also reviewed in this chapter. Moreover, this chapter provides a comprehensive study of the e-book and includes the e-book definition, the history of the e-book and the advantages and limitations of the e-book. In this chapter, the researcher has tried to shed light on the use of e-books in developing countries such as South Africa, Saltant Oman and Libya. It also reviews the use of the e-book in developed countries such as USA, UK, Germany and Canada.

**Chapter Three** is divided into two sections. The first section investigates the theories of the Technology Acceptance Models, such as the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Theory of Acceptance Model (TAM). Furthermore, it also explains the limitations of these theories. This section provides a review of the previous literature that has used the TAM model to study the acceptance of the e-book among higher education students. The second section includes a review of the history of Structural Equation Modelling (SEM). The features of SEM, path analysis, estimating models and sampling, as well as SEM analysis processes, are also discussed in this section. This section also involves an explanation of some of the models commonly used in SEM, such as Multiple Regression models and path models. The last subsection includes an illustrative table for the types of software that are usually used by SEM.

**Chapter Four** discusses the research framework and provides more explanation of the development model factors, including the external factors, TAM constructs and gender. It also describes the research methodology, which provides a detailed explanation of the research design and settings of the research. There are several steps that are indicated in the setting up of the research stage, such as research field study approval, designing of the e-book and guidebook, as well as human ethics approval. The design of the questionnaire, the size of the sample population, and the method of data collection is also

discussed in this chapter. Finally, this chapter also reviews the techniques used to analyse the data.

**Chapter Five** explains the data analysis process and includes several sections. Data screening represents the first section of Chapter Four. In this section, the data is checked and processed. The second section involves descriptive statistics. Some tables and figures are used to explain students' knowledge and experiences on the use of the e-book. In the third section, the model measuring process is carried out through the Exploratory Factor Analysis (EFA) using SPSS. Then, the processes of data analysis using SEM are explained. The Structural Equation Modelling process is carried out through two approaches, namely, Confirmatory Factor Analysis (CFA) and structure model analysis. The Measurement model and structural models are the most important stages in data analysis processes. This chapter also explains the moderating impact of gender on the relationships among the factors affecting the acceptance of the e-book among MAS students at universities in Libya.

**Chapter Six** discusses the research results. The research findings are divided into five sections. The first section presents the descriptive statistics, which includes students' knowledge and experience. The second section addresses the results of the developed model that is responsible for deciding to accept or reject the research hypotheses. The third section discusses the role of the extrinsic and intrinsic factors. The next section indicates the developed model's performance and its ability to predict students' behavioural intention. Finally, the results of the moderating effect of gender can be found in the last section of this chapter.

**Chapter Seven** provides a summary of the research objectives and how these objectives are achieved. It also deals with the research contributions provided by this research. The summary of the research findings is also offered in this chapter. Finally, the research limitation and recommendations for future research are mentioned in the last section of this chapter.

## **2 Chapter Two: Literature Review**

### **2.0 Overview**

As mentioned in the previous chapter, ICT has proven to have a significantly invaluable potential that can serve to promote education especially that related to the higher education sector. Therefore, this chapter reviews the impact of using technology in higher education, specifically in Libya. Furthermore, the ICT policy adopted by the Libyan government is described. The challenges facing the adoption of technology in the educational sector in Libya are also reviewed in this chapter. Moreover, this chapter provides a comprehensive study of the e-book. This also includes the definition and history of the e-book, as well as its advantages and limitations. Moreover, this chapter discusses the use of the e-book in some developing countries, such as South Africa, Egypt and Libya. It also includes the challenges that still face the adoption of the e-book in developing countries. This helps to shed light on the Arab world in general and Libya in particular. On another hand, this chapter reviews some of the literature on the use of the e-book in developed countries, such as USA, UK, Canada and Germany. This chapter also provides an in-depth study of the reasons that have led to the lack of preference for the e-book by students at most universities in developed countries.

### **2.1 Education and Technology**

One of the fundamental methods that act as a means or enabler of acquiring knowledge, is ICT. ICT is the force that has changed the life of people in many aspects such as law, medicine, banking, architecture, tourism, etc. The method of work in these areas today is quite different from the methods used in the past decades (Oliver & Herrington, 2003). Technology has caused a tremendous breakthrough in the field of education as well.

Recently, many researchers have adopted technology as one of the important drivers in the development of the method of teaching and learning (Rhema, 2013). The use of ICT



in education has contributed to the improvement of the learning process, especially in the field of higher education (Rhema & Miliszewska, 2010). The evolution of technology has supported the change in the educational methods in the education process at the tertiary level. The use of technology in education has achieved impressive outcomes (Boud & Prosser, 2002). The spread of new technology for education has coincided with many theories, and it is further recognised that there are many problems and shortcomings in the traditional methods of education. As a result, this has necessitated the use of modern technology to upgrade the educational process (Oliver & Herrington, 2003). After the emergence and spread of technology in the 21st century, there is a need to integrate technology in education, particularly in teaching and learning (Niess, 2005).

There have been numerous reports pertaining to the impact of ICT on education (Youssef & Dahmani, 2008). A few research has been conducted with the aim of attempting to determine both the enhancement of the learning environment that is seen to be afforded by technology and the positive effects that can be gained from the adoption of these technological advancements in the learning process (Jhurree, 2005). It has also been pointed out by Yusuf (2005) that various segments of the educational field such as learning, research and teaching have already been affected by ICT.

#### **2.1.1 Higher Education Sector and Using ICT**

Higher education can be seen to be at the very heart of educating a society to secure better economic development advances (Giroux, 2006). Higher education, in most cases, refers to the education offered post-high school education and is often seen to include studies undertaken at the undergraduate and graduate level, as well as the training offered at technical schools. Higher education is often found to be quite critical in the overall transformation of a country's economy and especially so with the globalisation of markets; the development of technology, increased connectivity and the various emerging economies are seen as opportunities more than ever, to reap the immense benefits of having an educated workforce. This is because higher education is currently seen to be the level of education that is mainly affected by technological advances (Giroux, 2006).

Across the world, most institutions offering higher education are currently experiencing a period of rapid change as they attempt to adapt themselves following the rapid advancement of ICT and technology. This trend can be seen to be bearing a number of similarities with the relationship existing between the principal processes. With this trend, they are found to be employed in the granting of degrees and the undertaking of studies at the university level and the various contextual trends that generally tend to affect aspects such as lifelong learning, customer orientation and virtualization (Fry, Ketteridge, & Marshall, 2008). These aspects can be perceived to be the fundamental facets of the general society (Collis & Moonen, 2001). To ensure that they manage to sufficiently keep pace with the ongoing developmental trends that have been spurred by ICT, most traditional universities have found it critically important for them to ensure that they alter their traditional modes of instruction. This aspect exemplifies that it is fairly unavoidable for all persons in the modern day society, and particularly so, persons in the educational milieu, to ensure that they adapt and sufficiently adopt the 21st-century technological advances (Ali, 2003; Collis & Moonen, 2005). ICT has proven to have a significantly invaluable potential that can serve to promote both economic and social progress not only in the developed world but also in developing countries (United Nations, 2004) (a view supported by (Statistics, 2006); Nafukho (2007)).

The progress of ICT (i.e. the Internet) has a significant influence on the development of the methods of teaching and learning in higher education, leading to a greater distribution of knowledge transfer (Rhema, 2013). This change plays an important role in developing countries that lack the necessary resources and infrastructure (Rhema, 2013).

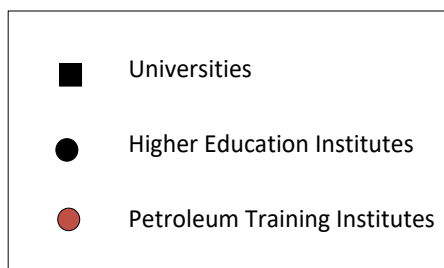
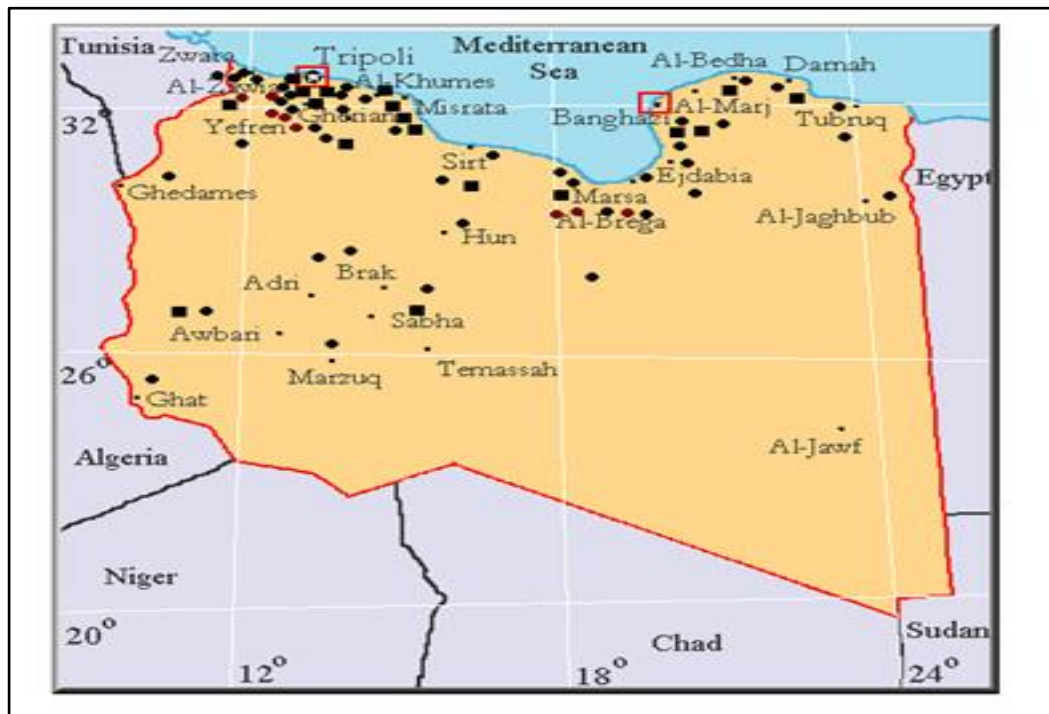
### **2.1.2 Adoption of ICT in the Higher Education Sector in Libya**

Libya is one of the developing countries that is still struggling with the adoption of ICT in higher education (Rhema, 2013). The following subsections will address the use of ICT in the higher education sector in Libya, ICT policies and the obstacles that are facing the use of technology in Libya.

#### **2.1.2.1 Country's Profile**

Libya enjoys an important geographical location, where it mediates the northern continent of Africa and borders the Mediterranean Sea coast about 2,000 kilometres (Tamtam *et al.*, 2011). Libya also extends over a wide area of approximately 1.8 million square kilometres, where it is bordered to the east by Egypt and Sudan, Chad and Niger on the south side and Tunisia and Algeria from the west (Ismael, Ismael, & Jaber, 1991). Libya is the fourth largest African country in terms of area and seventeenth globally (Ismael *et al.*, 1991). It is worth noting that Arabic is the official language used in education (Hamdy, 2007). The number of people in Libya is approximately 6.4 million (Tamtam *et al.*, 2011), including 1.7 million students, of which more than 270,000 studies at higher education institutions (Hamdy, 2007). According to Tamtam *et al.* (2011), in the early 1980s, there were approximately 35% of women and 70% of men who were literate. This rate gradually increased to above 81.3% for women and more than 90% for men in 2004. In fact, in the higher education sector, the percentage of educated female has increased sharply as compared to their male counterparts, where it has risen from 79.05% in 1995 to 112.8% in 2006 (Abdulatif, 2011; Al-Hadad, 2015).

Several studies have indicated that the literacy rate in Libya is the highest in the developing countries in general, particularly in the Arab world (Hamdy, 2007; Rhema & Miliszewska, 2010; Tamtam *et al.*, 2011). Since 1981, the large increase in the number of students who have enrolled in institutions of higher education has led to the restructuring of the university system and the introduction of many public universities (El-Hawat A., 2000). Currently, there are more than 18 universities, including about 148 specialised faculties and 500 scientific sections, in addition to a large number of private universities, colleges and Petroleum Training Institutes. Figure 2.1 shows higher education institutions and their geographical distribution in Libya (Rhema, 2013).



**Figure 2.1: Higher Education Institutions in Libya**

#### **2.1.2.2 ICT Policies in Libya**

In 2005, the Libyan Government developed a national policy that would help in guiding the integration of ICT into the country's educational system (Tamtam *et al.*, 2011). The policy hoped to help the drive towards modernization, developing ICT skills in the various sectors within the different communities, provide relevant ICT tools and infrastructure, as well as enhance access to ICT. This policy is currently being managed by the country's Ministry of Education and the Vocational Training Ministry. The two ministries receive additional support from major telecommunications providers such as Libya Telecom and Technology and General Postal and Telecommunication Company (GPTC)

(Hamdy, 2007). A cellular service based on the GSM standard is also provided by Ericsson and Orbit Telecom for GPTC (Hamdy, 2007). Table 2.1 illustrates the overview of the national ICT infrastructure in Libya (Rhema & Miliszewska, 2010). Although Libya has the largest stake in mobile phone use in North Africa, it is still slow in terms of internet penetration and use. The number of mobile users in Libya increased rapidly to reach 100% in 2008 and 135% in 2009. However, there are a large number of users who still rely on the dial-up connection to access the Internet and just 51,000 broadband subscriptions in Libya (Verma *et al.*, 2012). According to Verma *et al.* (2012), internet usage is expected to grow with the appearance of the first commercial wireless network (WiMAX) by the state-owned Internet Service Providers (ISPs) in January 2009. However, armed conflict in Libya has had a devastating effect on internet freedom in the country (Freedom house, 2015). Telecommunication services were disrupted in general due to armed attacks on power plants and the destruction of the infrastructure of most telecommunications companies. Prices for internet connections have increased due to limited availability and difficulties of movement with insecurity in the country (Freedom house, 2015).

**Table 2.1: ICT in Libya**

<b>Indicator</b>	<b>Numbers</b>
Telephones - main lines in use (2008)	1,033,000
Telephones - mobile cellular	4,828,000
Internet users (2008)	323,000
Internet hosts (2009)	11,751

By promoting cooperation between the country's private sector and the government, it is hoped that this will serve to improve Libya's ability to implement a variety of large-scale ICT initiatives. It should be noted that the primary function of this policy is to promote the use of various instruments of modernization such as e-learning and ICT to help in the enhancement of the Libyan education system (Rhema & Miliszewska, 2010). According to Hamdy (2007), some of the avenues that the policy intends to utilise to ensure it achieves its intended objectives include:

1. Boost the profile of higher education in the country.
2. Implement a raft of measures that will serve to encourage both local and global scientific communities to conduct an increased number of research studies within the Libyan population.
3. Make advances aimed at initiating positive developments aiding both distance and open learning.
4. Adopt various modern technologically-assisted educational methods and techniques and encouraging the country's private sector to subscribe to funding specialist and higher education within the country.

The Ministry of Education confirmed that the adoption of ICT in Libya would open the door to the use of new ways of teaching and training, which has the ability to develop and improve the standard of higher education in Libya. The global deployment of ICT has enabled many to use technology in different areas, whether it be at work, home, university or in the field of entertainment, which has led to an increase in the number of users in Libyan universities (Othman, Pislaru, & Impes, 2013a).

The Libyan government has plans aimed to develop the infrastructure for ICT in Libya, as it seeks to renew the educational process as a whole, including curriculum development and modernization of the scientific content (Hamdy, 2007; Rhema & Miliszewska, 2010; Tamtam *et al.*, 2011; Rhema & Miliszewska, 2012). For example, the Libyan government has allocated an amount of USD 60 to support a pilot project for e-learning in 2009 (Rhema & Miliszewska, 2010).

The Libyan government also seeks to encourage research and development, because the main objective of the national policy for using ICT in education is to invest in human resources and create a strong society capable of competition worldwide (Rhema & Miliszewska, 2010). Consequently, there is a growing number of technicians and professionals who have been well-trained well in the field of ICT and who know about the ICT systems and development (Elzawi *et al.*, 2012). In conclusion, with respect to these proposed technological advances, the Libyan government is planning on reforming the country's entire educational system in addition to further developing the existing ICT

infrastructure. Some of the measures that the government intends to take, that are in line with these prospects, include technical service and teacher training, promoting the use of e-books as opposed to textbooks in the country's educational institutions and the development of modern curricula (The General People's Committee of Education, 2008; Rhema & Miliszewska, 2010).

#### **2.1.2.3 Implementation of ICT in Higher Education in Libya**

Electronic education can be described as the utilisation of ICT in the learning process (Ashwin, 2005; Laurillard, 2006). Similar to most developing countries, the use of ICT in higher education in Libya is at the beginning of the road (Hamdy, 2007; Rhema & Miliszewska, 2010). Although most universities in Libya such as Tripoli University, Garyain University and Academy of Postgraduate Studies have managed to lay out the basic ICT infrastructure, these universities are still using a traditional education model. The model's main characteristics include having most of its learning activities being only available on campus and being heavily reliant upon face-to-face interactions between students and teachers both in and outside of the classrooms. It can also be noted that these universities have yet to widely adopt a culture of using e-books in their libraries (Rhema & Miliszewska, 2010). The adoption of ICT as tools allows students in institutions of higher education an opportunity to use a wide range of applications and communicate through all available forms of technology. However, the Libyan student still lacks the awareness and expertise on how to take advantage of these tools to develop his/ her educational level (Rhema & Miliszewska, 2010).

Rhema and Miliszewska (2011) argue that using ICT has successfully helped in the provision of adequate responses to several of Libya's educational problems. It has helped in the improvement of the processes involved in providing students with feedback pertaining to their assessment tasks. It has also helped in greatly improving the quality and flexibility of group work, as well as helped provide a greater variety of learning modalities and resources. Moreover, the use of ICT in the education sector allows students to benefit from many advantages offered by electronic education (Al-Kilani, 2011; Othman *et al.*, 2013a).

However, according to Tamtam et al. (2011), Libya still suffers from many challenges in the higher education sector. Therefore, institutions of higher education in Libya are still not able to make a quantum leap in the higher education sector through the use of modern technology. Tamtam et al. (2011) sum up these challenges in some important points as follows:

1. There are complaints about poorly chosen academic administration at all levels of the higher education institutions; as most of them lacked a criterion when selecting successful leaders, especially academic leaders, who have the ability to achieve the aims of the higher education sector in future.
2. The weakness of the current curriculum compared to the curriculum used by prominent universities in developed countries, especially after the use of new technologies in the education system, such as e-books, which have great flexibility for the update. Also, most higher education institutions are still using traditional methods of teaching and learning. For example, there is a focus on the indoctrination and conservation, as well as the omission of the use of self-learning skills such as search and self-development, analytical thinking, problem-solving, innovation and research skills.
3. A lack of programs for the training and developing of faculty members to enhance the quality of the higher education system.
4. The impairment of scientific competence for university students, and failing to heed the conditions and requirements of the labour market.
5. A lack of funding mechanisms available to adopt various types of electronic technologies, such as the use of the Electronic library (e-library). The e-library can help to save a lot of time and effort for researchers, rather than turning to the use of printed journals and books.
6. The absence of necessary studies that provide the information for decision-makers to make the appropriate decisions for the adoption of technology in the field of higher education as compared to the neighbouring countries. For example, most of the neighbouring countries show support for the use of e-books in higher education, providing e-libraries and necessary facilities such as the Internet and necessary



hardware for students to use the e-book, while Libya still lacks this technology in its universities.

7. The absence of a common policy (based on specific scientific and international standards) regarding the acceptance of students on the degree of research.
8. A lack of participation by faculty members in the area of the research, due to the weight of the teaching load.
9. The absence of research, especially in Applied Science and Engineering, due to the weakness of the possibilities available.
10. Instability of the administration and the continuous change in the laws and regulations enforced by the institutions of higher education, making the development of academic programs difficult, if not impossible in some cases.
11. The institutions of higher education and their administration have failed to build a relationship with the labour market through developing undergraduate and graduate programs to suit the requirements of the labour market.

This research deals with the problems mentioned in points 5 and 9, where the research outputs have important implications for decision-makers in the area of the e-book in the higher education sector in Libya. The outcomes could provide some motivation for the decision makers to take note of the critical success factors in this research.

#### **2.1.2.4 . Challenges Facing the Adoption of ICT in Higher Education in Libya**

McConnell (1994); Hodgson *et al.* (2014) strongly emphasise on the fundamental value of using various networking technologies to enable both distant and on-campus students to further their learning through collaboration and social interaction. Ashwin (2005) points out that a number of similarities can be drawn between the manner in which the development of some historical inventions such as libraries and the printing process have helped in increasing the degree of participation and access to the written word and the manner in which the development of these modern technologies is helping to increase the access and availability of higher education, as a result of the increased use of these various technologies in accessing a wide range of different ideas.

It should be noted that there still exists a number of challenges that continue to face potential students for ICT, especially those located in developing countries such as Libya. In a critical review conducted by (Grönlund *et al.*, 2009), Andersson and Grönlund (2009) have successfully managed to identify about thirty of the challenges. The review groups these challenges into four main categories, mainly being: (1) technological challenges; (2) contextual challenges; (3) contextual challenges impacting institutional organization and management, as well as the surrounding society's regulations and values; and (4) the challenges pertaining to a number of individual characteristics affecting both teachers and students.

According to Othman *et al.* (2013b), Tamtam *et al.* (2011) and Rhema and Miliszewska (2010), Libya, like any other developing economy, still suffers from many challenges in terms of the adoption of ICT implementation in the higher education sector. Rhema and Miliszewska (2010) and Rhema (2013) sum up these challenges as follows:

#### **1. Culture and Language**

Hofstede (1984, p. 385) defends culture as “*the collective programming of the mind that distinguishes the members of one group or category of people from another*”. People's perceptions about the adoption of ICT in education are completely different. Therefore, different cultures and the sensitivity of users (such as ethical issues and cultural communication (Rhema & Miliszewska, 2010)) must be taken into account when designing electronic education systems (Khan, 2000). Cultural communication such as some physical movements performed by humans to express specific meanings differs from one culture to another. For example, the thumbs-up symbol refers to an agreement in Arab societies such as Libya, as well as European societies, while using a similar physical movement will be akin to challenging people in Bangladesh (Rhema & Miliszewska, 2010).

In the field of e-books, the designer should take into consideration the directions of reading, colours and photos that are used when we talk in Arab societies such as Libya. For example, it is very important in Arab societies generally, when designing any e-books, to have to start from right to left, because that is how the Arabic language is written and read. Also, put pictures of women on the Internet sites are generally unwelcome because

that is contrary to the teachings of the Islamic religion. Otherwise, Western societies start writing from left to right, and they do not have certain restrictions on the images used.

Tamtam *et al.* (2011, p. 746) report that:

*“lifting language bans imposed and high unemployment rates due to a complex education system can be well addressed through providing a rationale of modern learning systems. A lack of diverse language skills in Libya has significantly degraded the capacity of students and ability to use available data due to language barriers”.*

The use of the Arabic language as the main language in education and the weakness of students' foreign language skills represent the important obstacles facing the adoption of e-books in Libya, where most of the e-books have been written in English (Rhema & Miliszewska, 2010). Therefore, this research examines the effect of the language factor on the acceptance of the e-book among MAS in higher education institutions in Libya.

## **2. Technological Problems**

Compeau and Higgins (1995) confirm that the provision of appropriate technological environments and the facilitation of the use of the technology applications are support for users and encourage them to use the technology in education. In order to achieve a jump in electronic education, several important facilities such as networks, software, hardware, computer devices, wireless signals, video and audio tapes and access to the Internet should be provided (Rhema & Miliszewska, 2010). Othman *et al.* (2013a) and Rhema and Miliszewska (2010) stress that the state of Libya still suffers from many difficulties in the technological field. Although Libya is a rich country and has great potential to support technological infrastructure, the infrastructure in Libya still remains as an obstacle to the adoption of ICT in education, especially after the destruction of much of the infrastructure of some educational institutions during the armed political conflict experienced by Libya in 2011. For example, the lack of appropriate network facilities is a serious issue relating to the access to the Internet. Table 2.2 illustrated that the internet usage in Libya is considered the lowest as compared to other countries in the region. After all,

the rate of the internet penetration in Libya is only 14%. Freedom house (2015) points out that:

*“Internet access has been badly affected by the ongoing conflict. Electricity outages and physical damage to infrastructure have limited connectivity. Despite that, there has been an increase in the number of internet users, particularly among youth. The quality of service remains poor, and the ICT sector remains monopolised by state-owned entities”.*

Technical service and support are one of the most important factors in determining the approval of the acceptance of technology in education, especially in the early stages of technology adoption, as seen in Libya. Rhema and Miliszewska (2010, p. 431); Rhema, Miliszewska, and Sztendur (2013, p. 159) confirm that *“the technical support is almost unavailable in Libya, which leads to delays in installation, operation, maintenance of equipment and software and further discourages users”*. Although the previous Libyan government has allocated an amount of a USD 60 million to support a pilot project for using ICT in education, most of these projects were halted by the armed conflict that led to their destruction or theft (Freedom house, 2015). Due to the importance of the factor of Technical service and support, this research measures the impact of this factor on the acceptance of the e-book among MAS in higher education institutions in Libya.

**Table 2.2: Percentage of Individuals Using the Internet**

Country	Percentage
Iraq	2.5
Yemen	12.4
Algeria	12.5
Libya	14
Syria	20.7
Egypt	26.7
Lebanon	31.1
Tunisia	36.8
Jordan	38

Kuwait	38.3
Saudi Arabia	41
Morocco	49
Bahrain	55
Oman	62
UAE	78
Qatar	81.6

#### **2.1.2.5 Institutional Support**

Institution leaders play a significant role in making decisions that may be responsible for the success or failure of any projects related to the use of technology in education (Mapuva, 2009). Therefore, administrative support is essential for the success of the adoption of ICT in the educational process (Rhema & Miliszewska, 2010; Rhema, 2013). However, Rhema and Miliszewska (2010) explain that most administrators in Libyan institutions lack the ability to deal with educational problems, especially those related to the development of the educational process and the adoption of technology in education. Therefore, the preparation and training of officials on the use of technology require time and effort. Also, they need to develop their skills and understanding of the administrative, pedagogical and financial implications of the use of ICT in the educational process (Rhema & Miliszewska, 2010).

#### **2.1.2.6 Technology Acceptance (Awareness, Attitude and Motivation)**

According to Sife *et al.* (2007, p. 63), an awareness goes hand-in-hand with the outlook attitude, since a positive attitude towards technology is widely seen as an essential condition for its successful implementation of the learning processes. Developing nations such as Libya still do not have the adequate awareness about using ICT in education.

The level of awareness of academic innovation and even computer experience in Libya is weak largely among the faculties and students of higher learning institutions in Libya (Rhema, 2013). For instance, most undergraduates in Libya do not have sufficient experience on how to obtain an e-book and use it; even those who have some skills use it

for leisure and not for the purpose of education (Smeda *et al.*, 2015b). A student incentive is an element that influences students' gratification and abilities. The features provided by the e-book can help to create a strong incentive for its use in education. For example, Muir and Hawes (2013) propose that the use of e-books could be an avenue that would serve to help strengthen students' ability to search by providing around the clock access to an authoritative source of information. This would enable all users to access any particular research material that they may happen to require in an effective, easy and quick manner. Personal incentive is one of the key paths to the success or failure of the incorporation of ICT and accepting the use of technology in learning. On the other hand, ICT might have an effect on students' incentives (Rhema, 2013; Andersson & Grönlund, 2009). Multiple studies show that ICT raises student involvement since it offers opportunities to move from teacher-based to student-oriented learning. This appeals to students and results in them taking pleasure in their learning. Nonetheless, numerous Libyan students, especially those new to computers, lack the incentive for electronic education, since their inexperience makes it hard for them to value its potential and advantages (Lam *et al.*, 2009). For example, most students use the e-book in a limited range, as the use is usually restricted to the entertainment side (Allen & Kaddu, 2014). One of the most important objectives of this research is to study the students' knowledge and experience towards using the e-book. On the other hand, the theoretical model in the current research aims to measure the students' attitudes and behavioural intention toward adopting of the e-book in their study.

## **2.2 E-book**

### **2.2.1 Definition of the E-book**

There are several definitions for the e-book, and they vary depending on their extent and nature. The e-book has been defined by the Dictionary (2011) (as cited by Embong *et al.* (2012b)) as being a book that is displayed on handheld electrical devices or computer screens, as opposed to being printed on paper.

E-books refer to the forms of books which are presented in the digital format to provide scholars and educators with tools that are applied to the teaching and reading content in a given area (Duncan, 2010). These e-books are purchased from online stores via downloading, while others are accessible freely from online libraries. Furthermore, other e-books are designed by students to meet their expectations and needs in terms of features.

E-books are seen to have three basic components such as the software, the files and the e-readers. A number of different portable communication devices have been designed to help users read their e-books. Some of these devices include e-book readers, personal computers, as well as smartphones. E-book readers are able to store a large number of e-books that can be easily accessed from any location (Wilson, 2001). Software-based e-book readers are described as being programs that are able to display e-book data on the hardware device (Embong *et al.*, 2012b). A key advantage of these software-based e-book readers is that they are designed to offer extra facilities through wider screen sizes and the use of a keyboard. Some of this software include the Adobe Acrobat Reader and the Microsoft Reader (Lynch, 2001). The content made available via the e-book files are available in a number of common file types such as Adobe Acrobat files that commonly have the \*.PDF extension, Microsoft Word files having the \*.DOC extension, HTML files having the \*.HTM or \*.HTML extension and plain ASCII text files having the extension \*.TXT (Embong *et al.*, 2012a).

Vassiliou and Rowley (2008) argue that most definitions of e-books that have been developed earlier are currently obsolete due to their heavy reliance on referencing access to specific technologies and readers. They are keen to define the e-book in two different parts. The first part of their definition essentially summarises the reasonable and essential nature of e-books while referring to their digital nature. In addition, the second part refers to a host of features such as reference material, search monographs and reference functions. They point out that these features will continue to become increasingly less significant as a result of technological advancements and thus causing it to require on-going revisions.

Embong *et al.* (2012b) and Kissinger (2011) believe that there are three basic components of the e-book that are used within the modern day context. The first component revolves around the use of words, texts, numbers and diagrams; content that is in the digital format and cannot be read without using electronic devices such as a computer or a tablet. The second component is the software through which the e-book content is uploaded and operated, e.g. something as simple as a text files application, such as the notepad on the computer. Third, the term 'e-book' itself means an electronic copy of the printed materials. Díez and Bravo (2009) sum up that the terms 'e-book' or 'electronic book' are utilised simultaneously to depict reading software, contents, formats and reader apparatus.

For the aim of this research, the researcher has selected the definition of Letchumanan and Tarmizi (2011a); Poon (2014), in which the e-book is a generic term that refers to the digital representation of printed material presented via electronic devices or mediums such as the personal computer, netbook, e-book reader, PDA, smartphone and iPad. The software of e-book readers allows for access on personal computers or any other e-readers devices, such as the Adobe Acrobat Reader, Microsoft Reader and Adobe Acrobat e-Book Reader (Embong *et al.*, 2012b). The content of the e-book primarily includes an electronic copy of the printed materials such as books (i.e. textbooks), research, journals and magazines (Poon, 2014). Most e-books have features that can be provided in an electronic environment, like within-book or within-collection note taking, searching, highlighting, hypertext linking, bookmarking, annotating and multimedia objects (Vassiliou & Rowley, 2008; Sieche *et al.*, 2013; Khanh & Gim, 2014; Park & Kim, 2014).

### **2.2.2 History of the E-book**

There is some controversy as to who the inventor of the first e-book is. There are claims that the very first e-book might possibly be the Index Thomisticus which happens to be a heavily annotated index consisting of the works of Thomas Aquinas. This index was prepared in the late 1940s by Roberto Busa. However, this claim is sometimes rejected, mainly because as opposed to being a published edition, this digitised text was at first meant to be a means of helping to develop a concordance (Priego, 2011). DeRose and Van Dam (1999) argue that Angela Ruiz, who was a teacher from Galicia in Spain, was



the first to patent the very first electronic book in 1949 with the intention of attempting to try to reduce the number of books that her students were required to carry to school. Some historians, however, assert that electronic books started sometime in the early 1960s in the form of the FRESS and Hypertext Editing System projects at Brown University that was headed by Andries van Dam and the NLS project at the Stanford Research Institute (SRI) that was headed by Doug Engelbart.

Another school of thought is that of the controversial story of the e-book which first started with Michael Hart's Project Gutenberg in 1971, where they used computers to search, retrieve and store information. The books that had been digitised by Hart came to be known as electronic versions of printed books or simply put, e-books. Project Gutenberg has since advanced to create thousands of copies of books and free texts that can easily be accessed and downloaded online (Grimes; Flood, 2011; Embong *et al.*, 2012b).

It is believed that Andries Van Dam was the first to coin the term, 'electronic book' with the first widely available e-book entitled, 'the Electronic Thesaurus', that was published by Random House in 1981 (DeRose & Van Dam, 1999). A handheld electronic dictionary was first introduced by Franklin Electronic publishers in 1986. This dictionary was able only to display a single line at a time. However, it was soon followed by the development of an electronic bible in 1991 that was able to display about four lines on the screen at a time and was also designed to have a keyboard (Rao, 2004). Other e-book reading devices that were developed also included Sony's Electronic Book Player or Data Discman and Franklin's Bookman (Doman, 2001).

Most of the early e-books were usually written for a limited audience and a few speciality areas and were usually meant for use by particular groups of individuals sharing the same interests or those who happened to be primarily devoted to the use of e-books. Most of the subject matter of these books mainly concentrated on the manufacturing techniques, hardware related technical manuals and a variety of other subjects. The increased availability of the Internet in the 1990s greatly eased the transference of files, which also included e-book files (Rao, 2004; Lebert, 2009).

### **2.2.3 Devices Used to Access the E-book**

There are a wide variety of electronic reading devices used to access and read the e-book (Doiron, 2011). This section reviews the most commonly used devices to gain access to e-books.

#### **1 Desktop and Laptop Computers**

A desktop computer is a personal computer that fits on or under a desk (Doiron, 2011). It usually consists of several units such as a monitor, mouse, keyboard and a Central Processing Unit (CPU), unlike a laptop or Personal Computer (PC) that can be carried and used anywhere, a desktop computer is designed to stay in one location. There are many e-books available to users on the PC. Some can be displayed within a browser, whereas others can be downloaded in an e-book format such as PDF or ePub (The Library of Congress, 2011).

#### **2 Handheld Mobile Devices**

The smartphone and other handheld mobile devices is a mobile phone with a computer where they have many of the features such as web browsing, the operating system and the ability to run software applications, such as Samsung Galaxy, iPhone, BlackBerry and Android (Doiron, 2011). These devices can be used to access e-books online or through the use of some applications (The Library of Congress, 2011).

#### **3 E-readers**

The e-reader was designed specifically to allow users to read e-books easily without having to use a desktop or laptop computer such as Kindle from Amazon, iPad from Apple and Nook from Barnes and Noble (Doiron, 2011). Some even possess proprietary file formats (The Library of Congress, 2011).

#### **4 Tablets**

A tablet includes all the features of the e-reader and more. It contains a software application to facilitate the collection and storage of e-books, for example, Amazon's Cloud Reader, Apple's iBooks and Xoom (The Library of Congress, 2011). Most of the tablets

can read e-books through some applications or online, where there are many types of e-books that are available for download (The Library of Congress, 2011).

#### 2.2.4 The Advantages of Using E-books in Education

E-books offer students an additional medium or tool of instructions that can support or enhance the learning process (Noorhidawati & Gibb, 2008; Letchumanan & Tarmizi, 2010; Embong *et al.*, 2012a; Roesnita & Zainab, 2013). Most educators, as well as modern librarians, advocate for the use of the e-book, citing the many benefits that are derived from this particular method of learning (Educause Learning Initiative, 2006; Pastore, 2008; Embong *et al.*, 2012b). According to Armstrong and Lonsdale (2003); Berglund *et al.* (2004); Rao (2004); Chang *et al.* (2005); Roesnita Ismail and Zainab (2005); Anuradha and Usha (2006); Educause Learning Initiative (2006); McKiel (2008); Nicholas and Lewis (2008); Noorhidawati and Gibb (2008); Pastore (2008); Vassiliou and Rowley (2008); Chelin *et al.* (2009); Embong *et al.* (2012b); Grenina (2012); Roesnita and Zainab (2013), the e-book has many advantages that can be summarized in Table 2.3.

**Table 2.3: Some Advantages of the e-book**

Authors	Year	E-book features
Rao	2004	Hyperlinking is one of the main advantages of using the e-book. The contents of the e-book can be linked to other pages or files inside or outside the book (Figure 2.2).
Vassiliou and Rowley	2008	It is relatively cheap in terms of cost. It is comparatively cheaper than the print forms because there are no printing fees associated.
Armstrong and Lonsdale	2003	Environmentally friendly. The environmental implications through the saving of trees as the source of papers for the otherwise printed materials.
Vassiliou and Rowley	2008	Ability to access information anywhere and at any time is a very important advantage that attracts many.
Rao	2004	E-books can be interactive. Authors can use multimedia such as video, animations, as well as audio clips, to convey the message more effectively. E-books provide a new dimension in learning for people who like reading through diversity. It may also provide new learning experiences to aid learning for people with disabilities who may find learning challenging. With the extra software, it is possible that some of the textbooks can be turned into audiobooks.

Vassiliou and Rowley	2008	E-books take up less space. Users only require very minimum physical space to store the e-book reader, and they can store hundreds or thousands of e-books on the e-reader device or computer.
Grenina Armstrong and Lonsdale Johnson Turner	2012 2003 2005	Due to the possibility of being updated electronically, e-books have a longer shelf life. It is easy to connect with the author to provide feedback and recommend possible changes to the learning materials. On the other hand, when the author wishes to update specific sections of the e-book; she/ he simply edits the electronic document, saves the new updated version, and then informs the customers about the new release.
Mckiel	2008	The e-book is searchable. This search facility allows the users to look for information almost immediately.
Vassiliou and Rowley	2008	Some e-books can have built-in dictionaries so that users can choose the different languages and click on the words to find out the meaning.
Grenina	2012	Most e-readers have a zoom in-and-out feature for easier reading, especially for the visually impaired (Figure 2.3).
Morrison, Wilson and Wynne	2004	Portability. Users who have many volumes of books can carry a whole library of books in their e-book devices without having to worry about weight.
Vassiliou and Rowley	2008	E-books are delivered immediately. Users can purchase, download and read in a matter of minutes. Users do not have to go to a bookstore or wait for days or weeks for delivery.
Vassiliou and Rowley	2008	The e-book has many tools, such as highlights and taking notes, that can help students to understand their subject matter (Figure 2.4).
Mckiel	2008	Possibility to bookmark pages. Users can easily go back to where he/ she stopped, write notes and draw or erase them (Figure 2.5).

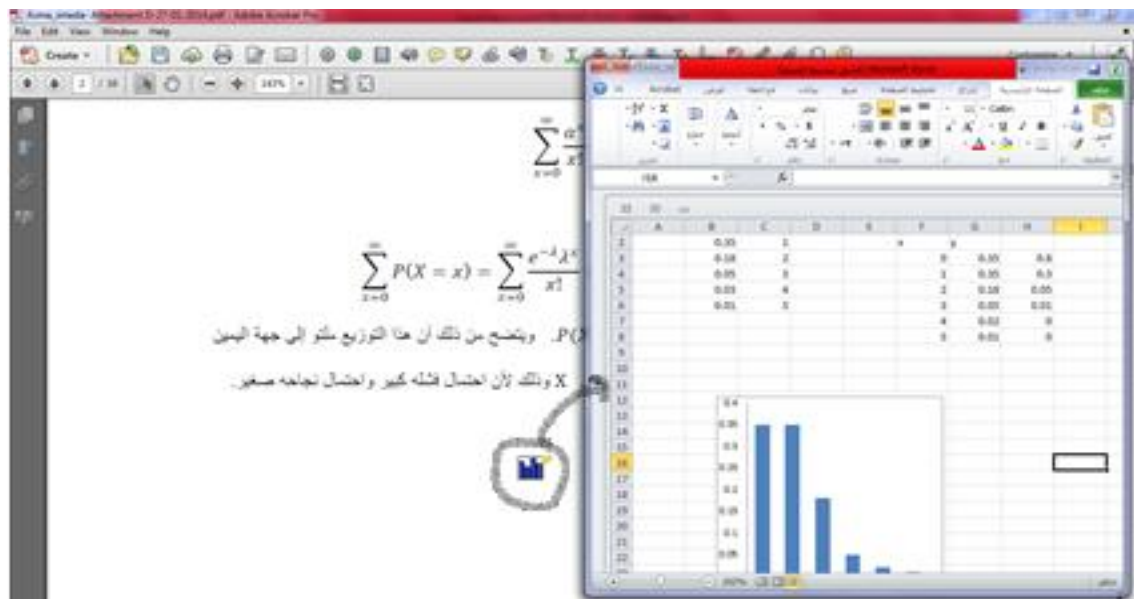


Figure 2.2: The Use of Hyperlinks with an Excel Sheet

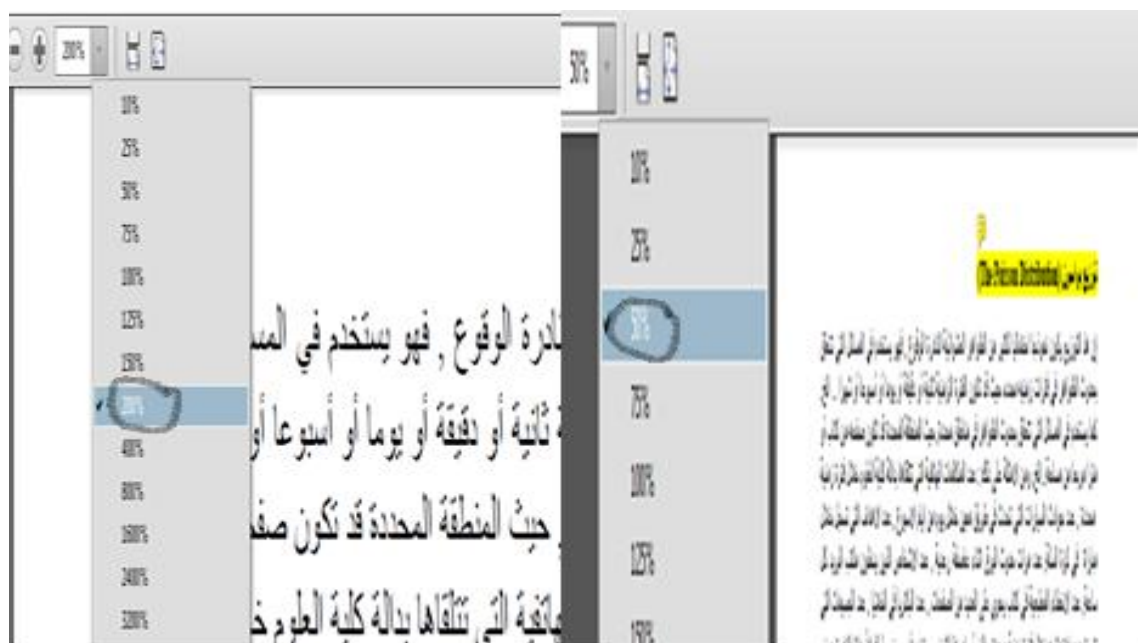


Figure 2.3: Example of Zoom and Control of Font Size



Figure 2.4: Example of Highlighting and Writing Notes

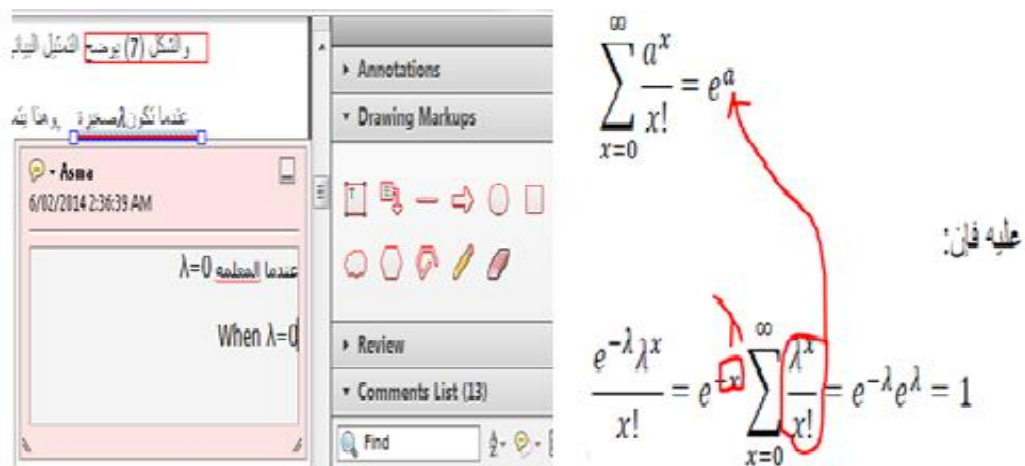


Figure 2.5: Example of Selecting a Drawing

### 2.2.5 Limitations of Using E-books in Education

Although most of the earlier studies have been carried out in different environments, in terms of culture and knowledge, most of the students voiced out the same arguments with regards to the lack of use of the e-book (Woody *et al.*, 2010). In developing countries, there are a lot of hurdles that are still facing the e-book users whether students or teachers

(Zinn & Langdown, 2011; Tosun, 2014; Smeda *et al.*, 2015b). Due to technological progress in developed countries, most of the libraries have been building and providing digital electronic collections of journals, reports, research, magazines and books. Therefore, the use of the e-book has become a common sight which shows the attraction of many readers (Folb, Wessel, & Czechowski, 2011). Nevertheless, the majority of researchers have found that there are limitations in the use of an electronic form of printed books, where most of the students still prefer using the printed books (Shepperd *et al.*, 2008; Chong *et al.*, 2009; Knutson & Fowler, 2009; Nariani, 2009; Slater, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; de Oliveira, 2012; Roesnita & Zainab, 2013; Wiese & Du Plessis, 2014).

According to Borchert, Hunter, and Macdonald (2009); Siracusa (2009); Weinstein (2010), complaints about the use of e-book devices include the size and quality of the screen, resistance to reading on a screen rather than holding a real book and the e-reading device itself (too small, too large or the fear of fragility). Shelburne (2009) points out that 33% of the participants believe that the problems of the devices used in reading the e-book represent the most significant disadvantage of the e-book, whereas 14% of the participants think that internet access and technical difficulties represent an obstacle to the use of the e-book. Only 10% and 8% of the participants see that the lack of knowledge about locating materials and search problems respectively are other issues facing the users of the e-book. Also, the e-reader devices have limited battery life and must be charged after a certain period of time (Waller, 2013). In addition, the reader device may be exposed to some technical problems that hinder the user from accessing the e-book. Moreover, some people who complain of eye problems prefer looking at paper instead of a computer screen (Kang, Wang, & Lin, 2009; Waller, 2013).

Other studies have attributed reasons for not using the e-book to issues such as slow loading times, short battery life, difficulties in browsing and navigating, and uneasiness when reading from the small screen of a laptop, personal computer or any other tablets (Gibbons, 2001; Chu, 2003; Roesnita & Zainab, 2013). Furthermore, the use of the e-book may also pose a difficulty for people who are not familiar with computers

(Weinstein, 2010). This problem is more common in developing countries such as Libya (Smeda *et al.*, 2015b). According to the study conducted by Smeda *et al.* (2015b) at three universities in Libya, the majority of students attributed the weakness of the use of the e-book for a number of reasons; most notably are not familiar with e-book, too difficult to access remotely and little knowledge on how to find and access e-book. Also, Knutson and Fowler (2009) express that e-book devices and e-books are quite expensive (Knutson & Fowler, 2009). When dealing with the e-book, the user must make sure that they store the documents to avoid losing the data (Waller, 2013). However, one of the biggest obstacles facing the adoption of an e-book in education is the failure of getting faculty members and students to use it (Nicholas & Lewis, 2010). Table 2.4 shows some of the main reasons that can prevent students from using e-books, whether in the developed countries that are still complaining about the scarcity of the use of the e-book as an alternative to the printed book or developing countries that are facing challenges in the use of most kinds of the e-book.

**Table 2.4: Main Reasons that Prevent the Use of e-books by Students**

Authors	Country of Study	Reasons
Smeda <i>et al.</i> (2015b)	Libya	Not familiar with the e-book; Too difficult to access remotely; Very little knowledge of how to find e-book.
Tosun (2014)	Turkey	I understand better when studying the printed book; I do not have the technology required to read the e-book; I like to carry the actual book in my hand.
Borchert <i>et al.</i> (2009)	Australia	Difficulty in reading from the screen.
Kang <i>et al.</i> (2009)	Taiwan	Causes eye fatigue.
Roesnita and Zainab (2013) Woody <i>et al.</i> (2010) Sieche <i>et al.</i> (2013)	Malaysia USA Germany	Prefer paper books.
de Oliveira (2012)	USA	Prefer paper books; not familiar with the e-book.
Letchumanan and Tarmizi (2010)	Malaysia	Not familiar with an e-book.
Croft and Davis (2010)	Canada	The absence of awareness of Royal Roads University Library (RRU) e-books;



		Choosing a print book.
Zinn and Langdown (2011)	South Africa	The cost of e-books is not reasonable; The weakness of the internet services; The lack of training on the use of e-books.
Fowler (2009); Marques de Oliveira (2012)	USA USA	Difficulties reading e-books and costs
Shelburne (2009)	UK	Breakdown of e-book awareness and attitudes of undergraduate students and faculty.
de Oliveira (2012) Gunter (2005)	USA UK	Lack of awareness of the e-book; Not aware of their availability in universities and eyestrain; Difficulty of reading.
Noorhidawati and Gibb (2008)	Scottish	Students were not aware of the availability of e-books in the university library.

#### 2.2.6 Use of The E-book in Developing Countries, Libya As an Example

Developing countries are the nations that are still struggling to raise the level of human development, industrial and technological progress level, such as Africa, Middle East, Southeast Asia, Latin America and parts of southern Europe (Cheibub, 2010; Rhema, 2013). These countries differ in term of political circumstances, religion, culture, the history of education development, language, gender issues, the size of the population, physical infrastructure, the capabilities and the level of technological development (Gulati, 2008). Therefore, the use of e-books in these countries may be different in terms of availability and acceptance. However, there are few statistics available in English from the developing countries. Thus, this subsection deals with the literature available in English, relating to the effectiveness and acceptance of the e-book. As a result of the scarcity of studies in Libya, the focus will be on the higher education students in the Arab countries generally, because the Arab nations are similar in terms of language, customs, traditions, religion, culture and the level of technology used in education. Although the developments in the field of technology are still ongoing (in order to redefine the working methods of many industries), the e-book is one of the latest technological developments in the

area of the development of communications technology (Kumbhar, 2012; Maduku, 2015b). Therefore, Margaret and Sarah (2014, p. 1) posed this question within the context of the African states, “*does the growing interest in information technologies imply a growing interest in e-books?*” It has been confirmed that many developed countries, such as America, Australia and Europe have a higher interest in e-books than the African countries. The difference is clearly shown by the size of the production of e-books and the volume of their sales in these countries. However, the use of the e-book in African countries is increasing gradually, especially after the emergence of mobile devices (Margaret & Sarah, 2014). In Southeast Asia, Sim *et al.* (2014, p. 1) report that “*in developing countries, e-books are still too limited to the top university libraries, and e-readers have yet to expand too expensive and too limited to users*”. Sim *et al.* (2014) also add that challenges and difficulties exist and may not be easily solved in the present time, but they hope for success in the future.

According to Maduku (2015b), the adoption of the e-book in South Africa is still very low as compared to developed countries such as the United States and the United Kingdom. The market of the e-book in South Africa represents just 1.5% of the total market of the e-book. Therefore, understanding the behavioural intention of users towards the use of e-book is one of the most important considerations in the efforts to increase the adoption of e-books in South Africa. Despite the widespread importance of behavioural intentions in users’ practices, there is a paucity of research focused on the factors that influence behavioural intent towards the use of e-book (Maduku, 2015a).

Wiese and Du Plessis (2014) conducted a study at the University of Pretoria for Marketing Management in South Africa. They investigated learners’ adoption and application of e-books to allow libraries to make more sound decisions concerning their e-books collections. The study included students who have the knowledge and sufficient experience to use an e-book. Most participants did not find the e-book friendly, of value and comfortable, in comparison to printed books. The results of the statistical analysis confirmed that 82% of respondents never or rarely used e-books (Wiese & Du Plessis, 2014). Most of

the previous research targeted the actual users of the e-book, while the non-users were often excluded.

Tosun (2014) examined the rate of the use of e-books amongst 258 students at Trakya University Faculty of Education in Turkey. According to the results obtained, just 20.9% of the precedents currently read e-books. The majority of students prefer to use printed books over e-books. The majority of students attributed the non-preference for the e-book to a number of reasons. For example, 98.8% justified their preference for the printed books because they are less expensive than e-books, 25.6% of participants selected printed books as it protects their eyes' health and 25.2% of participants like to hold the books in their hands (Tosun, 2014). More research is needed to understand the underlying factors behind the low level of the use of the e-book (Maduku, 2015a) .

There are very little studies in the field of acceptance and effectiveness of the e-book among higher education students and teachers in the Arab world (Aly & Gabal, 2010; Al-Suqri, 2014; Ebied & Rahman, 2015; Smeda *et al.*, 2015a, 2015b). Most of the studies available in the present time focus on the effectiveness of the e-book on academic development (Alzaq, 2008; Aly & Gabal, 2010; Ebied & Rahman, 2015). Recently, an empirical study was conducted by Ebied and Rahman (2015) to test the influence of using e-books on the academic development of computer students at the University of Najran in Saudi Arabia. The results of the statistical analysis confirmed the existence of a fundamental difference in the level of academic excellence for the students who used the e-book. The researchers believe that it is attributed to:

*“the multiple advantages supplied by e-books in increasing student motivation to learn and developing academic achievement, such as using multimedia within the e-book, easy to access, organization, easy to return to titles and texts in the e-book, in addition to the capability to load the book on tablets and mobile phones which makes it much easier to use at anytime and anywhere”* (Ebied & Rahman, 2015, p. 80).

Existing studies in the Arab environments focused the academic level of the students when using the e-book rather than explore the acceptance of the e-books among students and expected use of the e-books in education.

Aly and Gabal (2010) conducted the other empirical study on the sample of 48 female students at the Faculty of Physical Education at Menoufiya University in Egypt. The primary purpose of this study is to compare the effect of using e-books versus that of printed books in the teaching and learning in three courses namely Physical Exercise, Teaching Formations and Configurations, as well as body positions in the Physical Education Lesson (PE). The results indicated that both e-books and printed books have a positive influence on the three lessons. However, it seems that the impact of the e-book was more effective as compared to the printed book. Due to the positive implications of the e-book on the educational process, the researcher recommended using e-books instead of printed books. As mentioned, most of the research in the Arab countries aim to compare the academic level of the students who use the e-book in their study with their peers who used the textbook.

According to a survey conducted by Letchumanan and Tarmizi (2010), the results confirmed that there had been the insignificant use of e-books among Mathematics students at the Universiti Putra in Malaysia (UPM), 37.1% specifically. Most of the students attributed the lack of the use of the e-book to a number of reasons; most notably the fact that they are not familiar with the e-book, e-books are too difficult to access remotely and that the students are not confident with the technology. On the other hand, some of the results of the other studies regarding the use of e-books in other courses were relatively satisfactory. These results encouraged the researcher to study the effect of the familiarity and accessibility factor on the use of the e-book among MAS students at higher education institution in Libya.

Another study has come to emphasise the importance and effectiveness of the use of e-books in higher education. This study was conducted by Alzaq (2008) among Educational Technology Masters students at Menoufia University in Egypt. The results obtained from this study also confirmed the effectiveness of using e-books in increasing the academic

achievement and developing the students' skill and their attitude toward e-book (cited by (Ebied & Rahman, 2015)). Therefore, future research should highlight the study of the behavioural intent of students towards the use of the e-book. Understanding students' behavioural intention to use e-book provides critical insight and can enhance the impact of efforts to increase the use of e-book, especially there is a link between behavioural intention and future behaviour (Fishbein & Middlestadt, 2012).

According to the survey conducted by Smeda *et al.* (2015b) among MAS students at universities in Libya, only 43.7% of respondents have used an e-book previously. Indeed, these results are considered good for the higher education students in a country that has suffered from many difficult conditions, as a result of the armed conflict that destroyed a large part of the infrastructure of educational institutions and network communications. Based on the results obtained, being not familiar with the e-book was the main reason agreed upon by the majority of students (60.8%). The other reason is that the e-book is too difficult to access remotely (60.3%). Also, the results indicate that the e-book is not available in subject areas relevant to the students' program (59.6%) and there is also a lack of knowledge on how to find the e-book (59.5%). The low percentages obtained by the researcher prompted those interested in developing the education sector in Libya through the use of the e-book to question the factors that led to the low use of the e-book among the students. Studying these factors has become necessary to make appropriate decisions in this regard.

Roesnita and Zainab (2013) show that there was an increase of 13% in the use of e-books among students in Computer Science and Information Technology (FCSIT) at the University of Malaya (UM) in Malaysia. However, although these results were influenced by the increase in exposure to computers and IT amongst the participants of the survey, the level of the use of the e-book was very low (39%). This prompted the researcher to investigate the impact of self-efficacy and students' experience on the use of the e-book.

Al-Suqri (2014) studied the acceptance of the e-book among the faculty at Sultan Qaboos University (SQU) in the Sultanate of Oman. This study tested the acceptance of e-books among the faculty. The researcher ruled out the 45 potential users who have no experience

in the use of e-book previously, which means this study includes only real users of the e-book. The statistics obtained confirmed that the participants who acknowledged that the e-book is easy to use also tend to use it more. The rate of the use of e-books among the younger males who speak Arabic as the first language is larger than females, as well as higher than the older members of the faculty who do not speak Arabic as their first language. Studies targeting non-users of the e-book in Arab countries are still limited.

Based on previous literature, the studies that looked at the acceptance of the e-book among higher education students in developing countries in general and in the Arab world countries in particular, are rare. Moreover, research that is looking at the factors that influence the students' behaviour is almost non-existent. Therefore, this research attempts to cover this shortcoming and provide a comprehensive study of the acceptance of the e-book and the factors that affect students' behaviour in one of the developing countries, namely Libya. On the other hand, this research is targeted at the group of non-users of the e-book in Libya. Although the actual users of the e-book were few, they also participated in this research. The results obtained can be used to encourage non-users to adopt e-book in future.

#### **2.2.7 Obstacles Faced When Using an E-book in The Arab Countries in General and Particularly Libya**

Despite the positive impact of e-books on higher education students in the developed world, it is still not widely used in the Arab world (Al-Tarras, 2014). Defenders of the e-book believe that the use of the e-book allows the reader to take advantage of the many features available in most of the reading devices, such as multimedia (i.e. video, animation and audio clips), downloading, highlighting, accessibility options, note-taking, etc. These features can help the users understand the e-book contents and make reading more interesting (Cassidy, Martinez, & Shen, 2012). However, there are many obstacles that have led to the weakness of the Arab e-book market so far. Some of the issues are related to the users or potential users, such as language, users' experience and knowledge about the e-book and resistance to change (Al-Tarras, 2014). The language barrier represents an important factor, as mentioned by Ali and Magalhaes (2008) in their research in Arab

countries. Al-Tarras (2014) emphasises that *“the problem of display—of both Arabic fonts and a right-to-left language system—has not been completely solved yet”*. For example, the results that were obtained from e-textbooks were good but enhancing the applications to read Arabic books are still unsatisfactory, especially books with verses of the Holy Quran (Al-Tarras, 2014). At the present time, the PDF is the only format of the e-book, which helps in resolving this issue, but it is easily subjected to piracy (Al-Tarras, 2014). Al-Tarras (2014) also noted that due to the lack of e-books in Arabic, the lack of cooperation of all the publishing houses in this area and the problems related to counterfeiting, as well as piracy. In the Arab world, Censorship also represents one of the important obstacles that influence the e-book market. Because censors have the executive branch, they censor the digital world as well, in spite of the difficulties involved. As such, there are some sites that are blocked and some titles that cannot be downloaded in some countries (Al-Tarras, 2014).

The Report of Arab Human Development (2002) recommends that the policymakers in the Arab countries take positive steps to encourage entrepreneurs, professionals, scholars and students to translate or develop various documents in the Arabic language and post it on the Internet. Snaije (2012) reports that the company of Ramy Habeeb of the Egyptian Kotobarabia.com is the first company in the Arab world adopted a project to convert the printed books to e-books in Arabic. Unfortunately, no actual achievements have been made in electronic publishing in Arabic so far. Malkawi (2012) also points out that the process of converting books to e-books is a long process and requires financing. In addition, there is a lack of devices that accept e-books in Arabic (Nadia, 2007; Malkawi, 2012). In addition, the availability of the new version materials, payment issues, market problems and other issues related to technology itself or technology service still constitute an impediment to the use of the e-book (Margaret & Sarah, 2014). Besides all these challenges facing Arab states, Libya is still suffering from the lack of libraries that offer e-book services, especially in institutions of higher education (Rhema, 2013). Due to the absence of government support and encouragement for the electronic libraries, especially in higher education institutions, the level of using e-books amongst higher education

students in Libya is relatively low (Smeda *et al.*, 2015b). The uprising of the e-books is expected to take a long period before attaining acceptance in Libya. Therefore, this research seeks to cover this shortcoming and consider the extent to which some of the factors referred to above (i.e. language, Accessibility and libraries Services) have influenced the acceptance of the e-book among MAS at higher education institutions in Libya.

#### **2.2.8 Using E-books in Developed Countries**

As mentioned in subsection 2.2.1, the term of the e-book includes three basic concepts, which are hardware, software, and contents. The content of the e-book primarily includes an electronic copy of the printed materials such as books (i.e. textbooks), research, journals and magazines (Poon, 2014). In developing countries, the discussion has included all types of the e-book, because the use of e-book is still in the primitive stages, and students' knowledge about the use of the e-book is still narrow. Research in this area is also considered rare, if were non-existent in some countries, such as Libya. Therefore, the researcher preferred to use the definition of a more general and comprehensive e-book in this study. However, due to technological progress in developed countries, most of the libraries have been building and providing digital electronic collections of journals, reports, research, magazines and books. Therefore, the use of the e-book has become a common sight which shows the attraction of many readers (Folb *et al.*, 2011). Nevertheless, the majority of researchers have found that there are limitations in the use of an electronic form of printed books, where most of the students still prefer using the printed books (Shepperd *et al.*, 2008; Chong *et al.*, 2009; Knutson & Fowler, 2009; Nariani, 2009; Slater, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; de Oliveira, 2012; Roesnita & Zainab, 2013; Wiese & Du Plessis, 2014). Therefore, this subsection focuses on the use of the e-book as a substitute for the printed book. Massive research has been conducted to investigate the acceptance of using e-books in learning in different developed countries (Borgman, 2010; Al-Suqri, 2014; Tan, 2009). In studies conducted to evaluate the acceptance of the electronic version of the textbook (e-textbooks) as one of the most important types of e-books, the use of e-textbooks is still in the early stages (Brunet *et al.*, 2011; Folb *et al.*, 2011; Parsons, 2014). For example, Parsons (2014) discusses the



usage of e-textbooks among dental assisting students during their professional learning at the University of Southern Indiana. The results obtained confirmed that the students showed the acceptance of the idea of using e-books. However, the overwhelming majority of them (91%) preferred to use printed textbooks.

The study that has been conducted by Sieche *et al.* (2013) at the University of Hagen in Germany was fairly positive. The results obtained from the online survey found that nearly two-thirds of the respondents have actually used the e-book in the past. The ability to access anytime and anywhere (24/7) is one of the most important features that attract users to choose e-books, while non-users reported that the preference for printed books is the main reason for not using e-books. At the Union University in the USA, Walton (2013) also found that students prefer to use the printed books, despite the availability of the e-book, while they tend to use the e-book when it is the only available option.

Shimizu Wilson, D'Ambra, and Drummond (2014) discuss the role played by e-books to meet the needs of medical academics of the New South Wales University in the performance of their academic tasks. In this study, the e-book has been identified as the innovation which aims to replace the printed book. The results of the statistical analysis demonstrated that the usage of the e-book among medical academics was just 38%. However, most of them expressed their desire to use e-books in the future.

Cassidy *et al.* (2012) conducted a study among advanced researchers at Sam Houston State University (SHSU) in the USA. The objective of the study is to highlight the differences in perception, attitude, and behaviour between users and non-users of e-books (the electronic format of the printed books). The results obtained emphasised that a significant part of graduate students and faculty members have yet to use any library e-books for research. The results were unexpected: just 38% of faculty members and graduate students had used library e-books, whereas 54% of the participants showed their distaste for the use of e-books provided by the university library specifically or all e-books in general. However, the majority of these non-users did not dislike the e-book format. However, the main reason lies in the lack of awareness and thus, the lack of perceived needs for the use of the e-book provided by the library. Many researchers are

also not fully aware of all the features already offered by e-books, such as downloading, highlighting, accessibility options, note-taking, etc.

According to the survey at Andrews University located in the state of Michigan in the USA (Marques de Oliveira, 2012), the majority of students (87.9%) did not choose e-books. 87.9% of the participants preferred the print version of textbook, 12.4% were not familiar with e-books, 10% did not know how to find e-books, 9.5% were concerned about the cost of e-book devices and 5% attributed that to the lack of e-books in the subject areas relevant to their program of study.

Smyth and Carlin (2012) conducted a case study within two faculties at the University of Ulster in the UK. The study goals were to evaluate the levels of use of e-books, as well as to discuss the aims of using e-books among undergraduate students and assess the impediments to using or not use e-books, as well as the consideration of the promotional strategies. E-books are used thirty times more than their print counterparts, but users expressed a clear preference for printed books.

In 2011, Folb *et al.* (2011) conducted research on the groups of the Health Sciences Library System at University of Pittsburgh, USA, to assess the use of e-books and measure the factors influencing the use. The results obtained emphasised that just 55.4% of participants actually used library e-books. Generally, the participants preferred print for textbooks, while e-books were selected for research protocols and reference books.

The shocking findings of the research by Woody *et al.* (2010) at Andrews University in the USA are that there has not been any notable change in the preference of the textbooks to e-books, even with the evolution of IT within the century. They also found that just 59.3% of the respondents used e-books mainly for research and learning. Despite the advantages enjoyed by e-books, such as the ability to access additional content easily via hyperlinks and other features, students still prefer the features offered by printed books. In yet another research by Oliveira, about 12.1% of the General Psychology respondents at Northern Colorado in the USA have used or use e-textbooks compared to the larger percentage that has not utilised the e-book (de Oliveira, 2012). This further limited the

number of students who voluntarily used the e-book to merely 4% of the total sample for the research.

In a study conducted by Knutson and Fowler (2009), e-books received mixed reviews from students as a relatively low percentage acknowledged the use and effectiveness in using the service. Approximately 75% of participants preferred to use printed books. According to a study by Slater (2009), only Computer Technology and Computer Science students prefer the use of digital texts as opposed to print and were also regularly utilising e-books. A study conducted among students at Oakland University in the USA also revealed that History students also preferred the print format. This study was conducted by Borchert *et al.* (2009) at two Queensland Universities in Australia in order to investigate the level of awareness and use of the e-book, where more than 2,200 students and staff participated in the study. Analysing the comments and data gathered from a survey conducted at the York University of Toronto in Canada. The results confirmed that despite a high level of awareness of e-books amongst both students and staff (80%), the e-book was less used than was the printed book. The main reasons chosen by students to justify their non-use of the e-book included difficulty in reading from the screen (48%), the cost of printing pages (44%), the issues of online access (38%) and the problem relating to slow downloads (38%). However, the main negative points brought up by the staff were difficulty in reading from the screen (63%), the problem of slow downloads (47%), the cost of printing pages (43%) and problems of online access (41%).

Shelburne (2009) investigated students' perception and knowledge of e-books at the Illinois University in the USA. He asked them about their preference or lack of preference for the use of the e-book. More than 47,000 students in different stages (graduates and undergraduate) and academic staff at the Illinois University were invited to participate in this survey through the university e-mail. The study was conducted in association with Springer. Although most participants acknowledged using electronic articles and journals, most of them are still using printed books instead of books in the digital format. However, the data collected indicated that the use of e-book at the University of Illinois is growing rapidly.

A study conducted by Knutson and Fowler (2009) at the Northwest Missouri State University in the USA investigated the use of e-textbooks, instead of relying on the heavy printed texts. E-books received mixed reviews from students, as a relatively low percentage acknowledged the use and effectiveness in using the service. According to a study by Slater (2009) at Oakland University in the USA, only Computer Technology and Computer Science students prefer the use of digital text as opposed to print and were regularly utilising e-books. A study was also conducted among History students at Oakland University, and they also preferred the print format.

Based on the comments and data gathered from a survey conducted at the York University of Toronto in Canada, e-books are not used widely, especially among faculty members (Nariani, 2009). It is important for e-book promotion to try to capitalise on its searchability, convenience, and ease of accessibility of e-books as a format. This approach will be a result of the common perception that currently, most people tend to use the Internet extensively for their study activities and also as a consequence of the fact that most of today's learning activities are found to be frequently interlinked with a number of online applications and the Internet (Khan *et al.*, 2007).

Noorhidawati and Gibb (2008) investigated the usage and usability of e-books among the higher education students at Strathclyde University in Scotland. They identified the e-book as "*an electronic form of a book that can be viewed and read on a computer or portable device*" (Noorhidawati & Gibb, 2008, p. 2). The results obtained by the online survey confirmed that the rate of awareness of e-books and e-book usage amongst students was lower than expected. The reasons for this were that students had not developed an interest, which led to ignorance regarding the existence of internet connectivity and materials. Communication among students in the university libraries was ineffective. Thus, they were unable to access the availability of materials in various online stores, and this resulted in the underutilization of these resources.

Nicholas and Lewis carried out a survey in 2008 at the New England University in the USA regarding the attitudes of students towards the use of the e-book as compared to print materials and postulated another supportive argument to this finding. The study

found out that many people would prefer to use old printed materials as compared to the new and more simplistic method of learning via the e-book.

Shepperd *et al.* (2008) obtained supportive results in the same year when examining the perceptions and academic performance of students who adopted electronic materials compared to the others who used the normal print books in an introductory class to Psychology in the USA. 90% of participants have chosen the printed books for learning. Moreover, students who had previously chosen to use the e-book declined to purchase them in the introductory class.

In another study of acceptance of the e-book among faculty members and undergraduate students at a small college in the USA, 80% of the faculty selected the use of printed books over e-books for the preparation of research, 92% of the faculty preferred printed books over e-books as textbooks or reading in their leisure time (Walton, 2007). In contrast, 53% of undergraduate students preferred using the e-book for conducting research, while 18.5% used the e-book as their textbook and only 2% used the e-book in their leisure time.

Although the e-book age has nearly reached four decades, many researchers have discovered that the acceptance of e-books among users is still unsatisfactory (Anuradha & Usha, 2006; Levine-Clark, 2006; Woody *et al.*, 2010; Letchumanan & Tarmizi, 2011a; Letchumanan & Muniandy, 2013). Most students in developed countries are quite familiar with and use many types of e-books daily (i.e. journals, reports, magazines, etc.), but when it comes to reading a book, they prefer the printed text (Nicholas & Lewis, 2008). Several studies have been done in developed countries, but most of the users voiced out the same arguments regarding the lack of use of the e-book and preference for the use of printed books (Woody *et al.*, 2010). Despite the temptations and advantages offered by e-books, most of the participants in these studies have chosen to use printed books. Thus, the print is still the victor. Generally, the turnout regarding the use of the e-book amongst higher education students, even in developed countries, is somewhat weak. Li *et al.* (2011, p. 26) confirm that:

*“adoption of academic e-books and the movement away from print books remains a complex dynamic that is significantly influenced by one's area of study or research. Comments by survey respondents who both use and prefer academic e-books over print books remind us that the transition is far from easy”.*

## **2.3 Summary**

The use of ICT in education has contributed to the improvement of the learning process, especially in the field of higher education. This chapter is divided into two sections. The first section addresses education and technology. The use of ICT in education has contributed to the improvement of the learning process, especially in the field of higher education. Therefore, this subsection has highlighted the use of ICT in the higher education sector. Libya is one of developing countries still struggling to improve the education sector through the adoption of technology. This section has discussed the adoption of ICT in higher education in Libya (involving the Libyan country profile), ICT policies in Libya and using ICT in higher education in Libya. It also addresses the most important challenges faced by the sector such as culture and language, technological problems, support of institutions and acceptance of technology (awareness, attitude and motivation).

The e-book is one of the technologies used to improve learning methods. The second section covered in this chapter focuses on a review of e-books, including the definition, history of the e-book and devices used to access and read the e-book. Moreover, it also discusses the advantages and limitations of the e-book. Most importantly, this section goes in-depth into the application of the e-book in developing countries and the obstacles faced by these countries when using the e-book. In particular, it has focused on the countries of the Arab world, including Libya. This section also addresses the use of e-books in some developed countries such as Kaneda, Germany and the USA.

### **3 Chapter Three: Theories of the Technology Acceptance Models (TAMs) and the Structural Equation Modelling (SEM)**

#### **3.0 Overview**

This chapter investigates the theories of the Technology Acceptance Models (TAMs) and the Structural Equation Model (SEM). Section 3.1 addresses the TAMs, where subsection 3.1.1 includes the Theory of Reasoned Action (TRA). Subsection 3.1.2 contains the Theory of Planned Behaviour (TPB), and the Theory of Acceptance Model (TAM) has been discussed in subsection 3.1.3. Section 3.1 also describes the limitation of these theories. Section 3.2 addresses the Structural Equation Modelling (SEM); where an overview of the SEM is provided in subsection 3.2.1, while the history of its development is in subsection 3.2.2. Moreover, subsection 3.2.3 offers some important details about the SEM features and scope, while subsection 3.2.4 includes the estimation methods and sample size required. Subsection 3.2.5 discusses the SEM analysis processes through six steps. This chapter also reviews some of the types of models used in SEM and describes the most common and widely used models, which include the Multiple Regression models and path analysis model in subsection 3.2.6. The SEM software programs are described in subsection 3.2.7. The last section of this chapter consists of the summary.

#### **3.1 Theories of Technology Acceptance Models**

During the past two decades, many researchers have concluded that the adoption of technology is one of the important drivers in the development of education. Researchers are keen to recognise the status or factors that determine technology adoption and usage (Legris, Ingham, & Collette, 2003). Several models have been developed to aid in predicting technology acceptance. From these models, the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM) are derived; these are the models that are most widely used and investigated. Acceptance of the technology is constantly evolving due to the rapid advances in Information Technology (IT). The use and acceptance are two of the most important elements that

contribute to the improvement of these theories and models dealing with the acceptance of the technology.

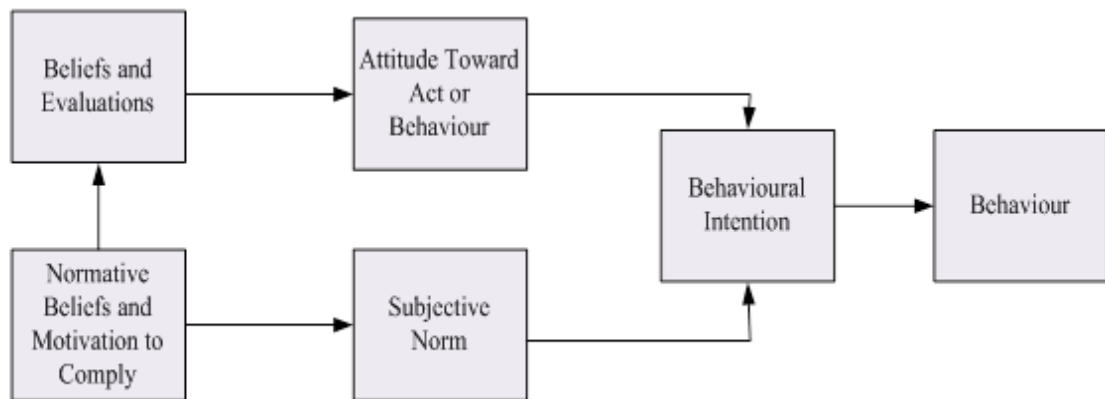
### **3.1.1 Theory of Reasoned Action (TRA)**

In 1980, the Theory of Reasoned Action (TRA) was formulated by Ajzen and Fishbein to study the relationship between behaviour and attitudes. This model is derived from a learning theory and presumes that behaviour towards a specific thing is estimated by an aim to perform that behaviour. An aim signifies an individual's conscious plan to use effort to perform the behaviour (Eagly & Chaiken, 1993). TRA was initially introduced in the field of Social Psychology, and since then, it has been extensively used to explain the behaviour of individuals (Fishbein & Ajzen, 1975).

The TRA assumes that behaviour is guessed by the intention of an individual to be involved in a given behaviour. In turn, the intention is anticipated by two aspects, the opinion of an individual's social environment and by the individual's attitude towards the result of the behaviour, which is known as the subjective norm. According to this theory, an individual's intention to carry out any action is a derivative of its relationship to these actions and subjective norms associated with these actions. The theory has proved that intention is behaviour's best predictor and the cognitive illustration of an individual's willingness to perform a given behaviour. Furthermore, it is considered to be the instantaneous precursor of behaviour (Fishbein & Ajzen, 1975).

According to Masrom (2007), the two factors engaged in behavioural intention are guided human activity and dominance. His viewpoints are supported by the distinct results of behaviour, assessment of these results, beliefs regarding the perceptive expectation of others and inspiration to pursue with this expectation (SN - Subjective Norm). As a result, the normative beliefs and behavioural beliefs can be the foundation on which to institute any further clarification for any action. Figure 3.1 shows the theoretical model of the Theory of Reasoned Action.





**Figure 3.1: Theory of Reasoned Action**

Subjective norm is determined by normative beliefs, whereas normative beliefs can be defined as an individual's approval or disapproval of others' behaviour and his desire to follow that behaviour. According to Masrom (2007); Ajzen (2011), the elements that formulate the Theory of Reasoned Action are Behavioural Intentions (BI), Subjective Norms (SN) and Attitudes (AU). The theory advocates that an individual's behavioural intentions depend on his subjective norms and attitudes, i.e.  $BI = SN + AU$ , where:

- AU (Attitudes) is the sum of viewpoints credited to a few facts. It differs according to the viewpoints and attributions.
- SN (Subjective Norms) are typically situational. It includes our opinions regarding the behaviour of the subject. An opinion can be affected by several factors like politics, economy, demographic factors and society, etc.
- BI (Behavioural Intention) implies an individual's capability to plan to perform the behaviour. It is relatively considered as the function of both behavioural norms and attitudes.

The founders of this theory formulated a simple formula,

$$\text{i.e. } BI = (AB) W1 + (SN) W2$$

In which:

- BI = behavioural intention

- AB = an individual's attitude towards performing the behaviour
- W = experimental derived weights
- SN = an individual's subjective norm related to performing the behaviour.
- SN = an individual's subjective norm related to performing the behaviour.

#### **3.1.1.1 Limitations of the Theory of Reasoned Action**

TRA suffers from a few limitations, and the correspondence factor is the first limitation (Ajzen, 1985). It means that to forecast attitudes, an individual's behaviour and intention to use should be linked to act, time and context (Wright, 1998; Al-Aulamie, 2013). Moreover, this theory is valid for use only in the case of voluntary behaviour, which has been already well thought out in a conscious person (Yousafzai, Foxall, & Pallister, 2010). Also, it cannot explain any behaviour that includes non-rational choices and complicated skills or social support (Wright, 1998; Al-Aulamie, 2013).

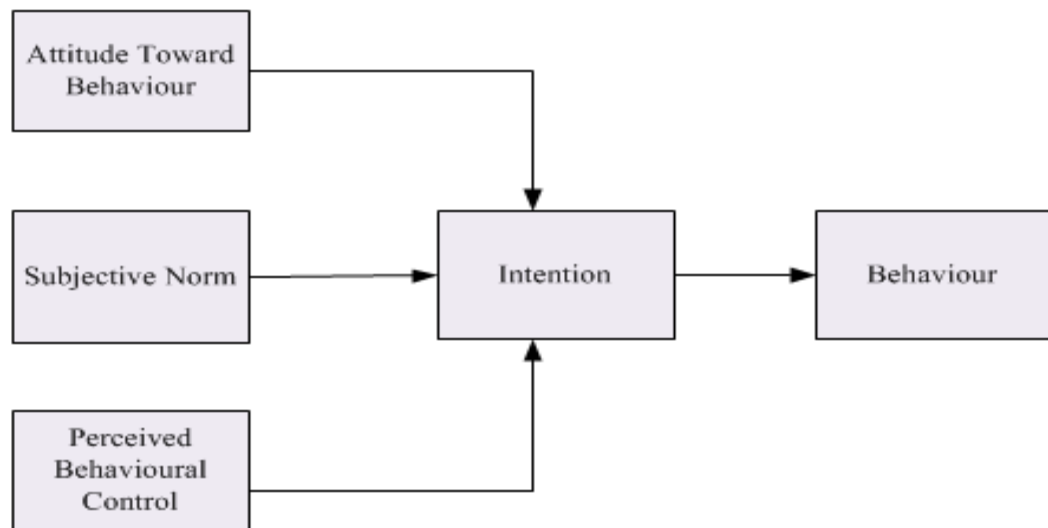
#### **3.1.2 Theory of Planned Behaviour (TPB)**

The Theory of Planned Behaviour (TPB) is an extension of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980). This theory deals with the problem of incomplete control of consciousness. In 1991, Ajzen suggested TPB, and since then, it has been extensively applied by researchers throughout the years.

The main difference between TRA and TPB is the addition of individuals, i.e. the independent ideological factors determining intent. TPB includes the attitude towards the behaviour and subjective norms, but it adds a component of perceived behavioural control (Ajzen & Fishbein, 1980). Hamilton and White (2008, p. 52) introduced perceived behavioural control as "*the amount of control individuals believe they have over performing a behaviour*".

TPB is capable of assessing a range of behaviours and intentions. An individual's actions are found out by behavioural intention, which consecutively is controlled by an attitude towards the subjective norms and behaviour. In addition, observed behavioural control could influence intention too. An individual's decision is influenced by

the perceived behavioural control through the behavioural intention in the TPB. Furthermore, behavioural intention is considered the most significant predictor of behaviour (Ajzen & Fishbein, 1980; Teo & Lee, 2010). Figure 3.2 illustrated the theoretical model of the Planned Behaviour Theory.



**Figure 3.2: Theory of Planned Behaviour**

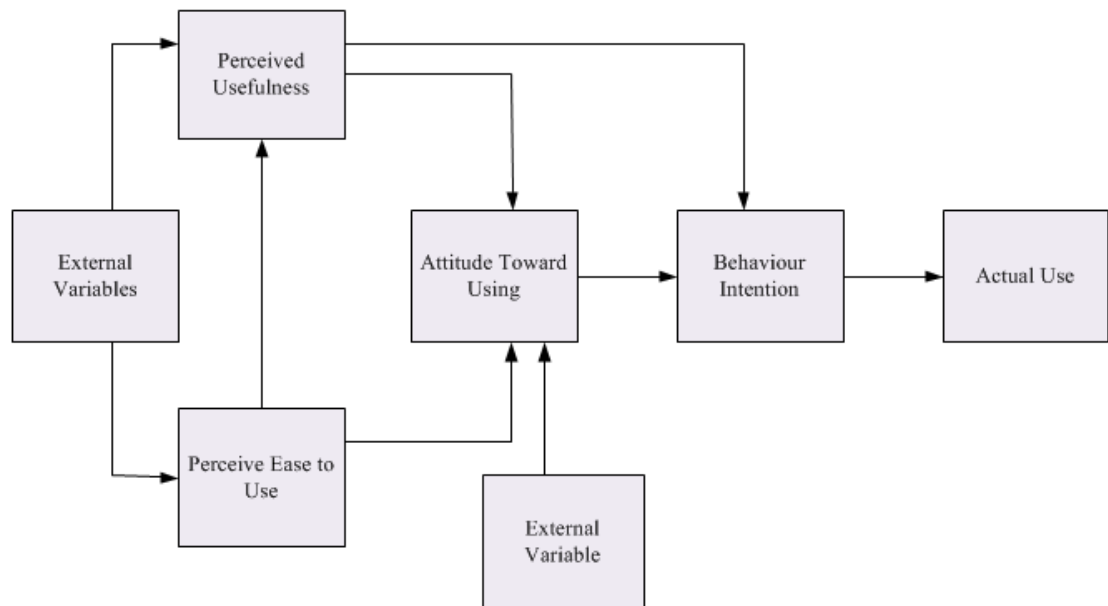
#### ***3.1.2.1 Limitations of the Theory of Planned Behaviour***

Although the TPB has addressed the volitional control limitation of the TRA, it is still facing many criticisms (Al-Aulamie, 2013). Firstly, both TRA and TPB suppose that an individual should be stimulated to carry out the behaviour. This suggestion may create an issue for the behaviour of the users because some external obstacles, such as price, do not allow for them to perform the behaviour (Taylor & Todd, 1995b). According to Ajzen (1991), the determinant factors for intention to use is not confined to the three proposed variables, namely subjective norms, perceived behavioural control and attitude. The other disadvantage of the TPB is that it brings together all emerging variants of control that affects the behaviour of the individual in one variable. Furthermore, experimental research showed that the TRA and TPB could only explain about 40% of the variation in an individual's behaviour (Taylor & Todd, 1995b).

### 3.1.3 Technology Acceptance Model (TAM)

Based on the Theory of Reasoned Action (TRA), the Technology Acceptance Model (TAM) was developed by Davis Jr (1986) and deals more particularly with the calculation of the suitability of an Information System (IS) (Masrom, 2007; Fishbein & Ajzen, 1975). The focus of the TAM is on the end users' acceptance behaviour of a number of different IT applications. The intention of this model is to forecast the suitability of a tool, so as to identify the adaptations which must be brought to the system, to make it satisfactory and acceptable to users.

The TAM is utilised to provide an elucidation of the determinants of computer recognition that is general and able to clarify user behaviour, i.e. use across user populations and an extensive range of user's computing technologies, while at the same time being both theoretically justified and economical (Davis, Bagozzi, & Warshaw, 1989). This model recommends that the suitability of an IS is determined by two major factors: PEOU and Perceived Convenience. As shown in Figure 3.3, there are two types of beliefs that can be used to determine the individual's behavioural intention to adopt a technology (Hashim, 2011). The first is PEOU that is defined as "*the degree to which a person believes that using a particular system would be free of effort*" (Davis, 1989, p. 320). The second is PU that is defined as "*the degree to which a person believes that using a particular system would enhance his or her job performance*" (Davis, 1989, p. 320). The main objective of the TAM is to identify the reasons that explain the impact of user's attitude on the acceptance of the technology.



**Figure 3.3: Technology Acceptance Model**

The TAM set apart certainty into PU and PEOU, to facilitate researchers to develop strategies to influence others to accept an IT framework, by means of convenient external aspects that have a substantial influence on perceived convenience, perceived ease of use or both (Davis, 1989).

Therefore, the ease of use of a framework can be improved by providing superior training to users or improving the perception of the system; system user interface; or the usefulness of system can also be enhanced by improving the quantity or/and quality of information available via the IT application (Davis, 1989).

According to Park (2009), the external variables, e.g. e-learning self-efficacy and subjective norms have affected the individual's behavioural intention by PEOU, PU and AU. Generally, the development of the TAM model can be divided into three stages: adoption, validation and extension (Al-Aulamie, 2013).

- **The adoption stage:** this stage addresses the fact that the TAM is parsimonious. Davis and his colleagues have worked to build a theoretically justified model that can be used to explain and expect user behaviour across various IT applications

(Gefen, Karahanna, & Straub, 2003). Consequently, these researchers have successfully demonstrated the applicability of the TAM over the targeted technologies in various applications of IS (Gefen et al., 2003). Table 3.1 presents some studies that used the model of TAM in different fields of IS.

**Table 3.1: Some of the TAM Research in Various Applications of IS**

<b>IS application</b>	<b>Author/s</b>	<b>Comments</b>
Key office IS applications	<ul style="list-style-type: none"> <li>• Mathieson, (1991)</li> <li>• Adams, Nelson, and Todd (1992)</li> <li>• Doll, Hendrickson, and Deng (1998)</li> <li>• Segars and Grover (1993)</li> <li>• Taylor and Todd (1995b)</li> <li>• Hu <i>et al.</i> (1999)</li> <li>• Venkatesh and Davis (1996)</li> </ul>	<ul style="list-style-type: none"> <li>• Spreadsheet calculator</li> <li>• Lotus 1-2-3</li> <li>• WordPerfect</li> <li>• Word</li> <li>• Excel</li> </ul>
Database systems	<ul style="list-style-type: none"> <li>• Szajna (1994)</li> <li>• Doll et al., (1998)</li> <li>• Venkatesh <i>et al.</i> (2003)</li> </ul>	Choice packages to build bibliographic database
Microcomputers	<ul style="list-style-type: none"> <li>• Igbaria, Guimaraes, and Davis (1995)</li> <li>• Igbaria, Parasuraman, and Baroudi (1996)</li> <li>• Agarwal and Prasad (1999)</li> </ul>	Companies in North America
Universities	<ul style="list-style-type: none"> <li>• Davis <i>et al.</i> (1989)</li> <li>• Venkatesh and Davis, (1996)</li> <li>• Hong, Thong, and Wai-Man Wong (2002)</li> </ul>	<ul style="list-style-type: none"> <li>• University of Michigan</li> <li>• Minnesota University</li> <li>• Open University of Hong Kong</li> <li>• Boston University</li> </ul>
Financial institutions	<ul style="list-style-type: none"> <li>• Montazemi, Cameron, and Gupta (1996)</li> </ul>	<ul style="list-style-type: none"> <li>• USA</li> </ul>
Internet-related IS applications	<ul style="list-style-type: none"> <li>• Venkatesh and Morris (2000)</li> <li>• Agarwal and Prasad (1999)</li> <li>• Parthasarathy and Bhattacharjee (1998)</li> </ul>	<ul style="list-style-type: none"> <li>• WWW</li> <li>• Online services</li> <li>• Digital libraries</li> </ul>

	<ul style="list-style-type: none"> <li>• Venkatesh (1999)</li> <li>• Chau and Hu (2001)</li> </ul>	<ul style="list-style-type: none"> <li>• Virtual</li> <li>• workplace systems</li> <li>• WWW information services</li> </ul>
--	--	--

- **The Validation Stage:** this stage can be split into two sections. The first section is the study of the psychometric properties of the main constructs of the TAM model; PU and PEOU. According to Davis (1989), PU and PEOU are fundamental constructs that affect the individual's decision to adopt any applications or systems of IT. As shown in Tables 3.2 and 3.3, Davis (1989) devised the detailed schedule that was used to measure the PEOU and PU and it was adopted by many empirical types of research in different applications of IT (Venkatesh & Davis, 2000).

**Table 3.2: Detailed Schedule that was used to measure PU**  
(F. D. Davis, 1989; Han, 2003)

Factor	Measures
PU	The system would improve an individual's job performance.
	The system would increase an individual's productivity.
	The system would enhance an individual's effectiveness on the job.
	The system would enhance an individual's ability to accomplish tasks more quickly.
	The system would make it easier to do the job.
	The individual would find the particular system useful on the job.

**Table 3.3: Detailed Schedule that was used to measure PEOU**

Factor	Measures
PEOU	Learning to operate the system would be easy for me.
	I would find it easy to get the system to do what I want.

	My interaction with the system would be clear and understandable.
	I would find the system flexible to interact with.
	It would be easy for me to become skilful at using the systems.
	I would find the system easy to use.

Many researchers have embraced PEOU and PU in various study settings. The reliability and validity of the PEOU and PU constructs were conducted in these different situations; the reliability and validity for all were statistically significant. Davis et al. (1989) examined the TAM by using “WriteOne”, a word processing program, by collecting data from 107 participants (Master of Business Administration students (MBA) from the School of Michigan Business). They used four variables to measure each construct (i.e. PEOU and PU), and the outcomes confirmed the high level of discriminant validity and convergent for the selected variables.

Therefore, Han (2003) points out that PU and PEOU are very powerful beliefs construct to determine user behaviour about computer technologies in organisations. Their measurement scales and psychometric properties are empirically shown to be robust. But we have to aware that for different users, their perceptions of PU and PEOU may vary across contexts in term of technology and organisation.

In the second section, the TAM has a strong causal link with their constructs (i.e. PU-BI, PEOU-BI, PU-PEOU) and other external variables. Many empirical studies have been conducted to test these causal relationships. The results obtained confirm the consistency of these relationships with the original TAM; except the causal relationship between PEOU and BI, which was inconsistent and requires further investigation (Morris & Venkatesh, 2000; Al-Aulamie, 2013).

**The Extension Stage:** many studies have added external or moderating variables to extend the TAM. They have participated in providing a more detailed explanation of the individuals' behavioural intention to adopt the IT system (Han, 2003). According to Venkatesh and Davis (2000), there are two extension variables of the TAM. The first



extension variables are used to identify the determinants of PU (i.e. TAM2). According to Venkatesh and Davis (2000), five variables are added: image, relevance, result demonstrability, output quality and subjective norm. The extended model is tested, and the outcomes confirm that PU has the strongest predictor of BI. The second extension variables are used to determine the significance of PEOU to predict behavioural intention (i.e. TAM3). The variables suggested by Venkatesh and Bala (2008) are the perception of external control, objective usability, computer anxiety, computer self-efficacy, perceived enjoyment and computer playfulness. Combining the determinants TAM2 and TAM3 provide more explanation to the extended model (Al-Aulamie, 2013). On the other hand, TAM is the best-performing model of all, because the strength of the explanation of behavioural intention is stronger than TAM2 and TAM3. Chin, Marcolin, and Newsted (2003) confirm the significant impact of moderating variables on the TAM.

#### **3.1.3.1 Limitations Of The Technology Acceptance Model (TAM)**

First of all, a lot of research works have been done using students as the population to test the acceptance of the technology model. As such, this restricts their ability to generalise the results (Lee *et al.*, 2003). Differing motives and point of views of the participants, whether from employees or students, created much controversy. As such, the researcher should select users who fit the study environment (Legris *et al.*, 2003; Yousafzai *et al.*, 2010; Al-Aulamie, 2013).

Secondly, the explanatory power of the TAM is influenced by many variables, such as the environment and type of participants. Therefore, its ability to explain the variation in the behaviour of individuals is relatively low (Venkatesh & Davis, 2000; Sun & Zhang, 2005). On the other hand, the external variables can help to improve the interpretive power of the TAM.

In addition, the TAM suffers from a lack of consistency between their contents. According to the results of some previous studies, the relationship among BI and PEOU is statistically significant (e.g. Van der Heijden (2004); Gefen *et al.* (2003) and Venkatesh and

Davis (2000)). However, other studies have proved that the PEOU is not significant towards behavioural intention (e.g. Park (2009); Chau and Hu (2001)).

### **3.1.3.2 Why the Technology Acceptance Model?**

The Technology Acceptance Model (TAM) is an extension of the TRA and TPB. The TAM is able to provide a means through which it is possible to study how the individuals accept the new technology (Marston *et al.*, 2014). By extension, via the TAM, the researchers are able to investigate the effects of some external variables such as age, sex and technical service on the behaviour of acceptance of the technology.

During the past two decades, many types of research have supported the validity of the TAM (Mathieson, 1991; Venkatesh & Davis, 2000; Hsia, 2007; Liu *et al.*, 2010; Al-Aulami, 2013; Marston *et al.*, 2014). The TAM is utilised to provide an elucidation of the determinants of computer recognition that is general, able of clarifying user behaviour (i.e. utilization across user populations and an extensive range of user's computing technologies, while at the same time being both theoretically justified and economical) (Davis, 1989; Davis *et al.*, 1989). This model recommends that the suitability of an IS is determined by two major factors: PEOU and Perceived Convenience.

During the procedure and following the proper corrective steps, practitioners and researchers utilise a model that is not only useful and practical for estimation and forecasting, but also for the elucidation of why a specific framework might be unacceptable (Fred D Davis et al., 1989). The TAM has established wide attention from researchers of Information Technology (IT) for three reasons. Firstly, it has a strong base in speculation. Dwivedi, Wade, and Schneberger (2011, p. 167) assert that “*substantial empirical and theoretical support has accumulated in support of TAM*”. Secondly, it could be utilised as a guideline to improve effective IT applications. In the duration of ten years, the model has become well-recognised as a strong, powerful and economical model for predicting user recognition (Venkatesh & Davis, 2000). Finally, according to Lee *et al.* (2003); Hashim (2011), for the past 10 years, a research stream supported the strength of the TAM

in a number of populations, settings and an extensive range of IT applications. Table 3.4 shows some application of IT that used the model of TAM.

**Table 3.4: Some IT Applications that Used the TAM**

<b>IT applications</b>	<b>Year</b>	<b>References</b>
E-learning framework WebCT	2006 2008	Pituch & Lee; Lee & Lee
Spreadsheet	1995 1996	Compeau & Higgins; Venkatesh & Davis
Microcomputer/ desktop computer	1995 1996	MagidIgbaria; M. Igbaria & Iivari
Email	1993 1996	Fred D Davis; Venkatesh & Davis
Graphic software	1996	Venkatesh & Davis
Window-based multifunctional work-station	1999	Lucas & Spitler
News websites	2000	Chuan-Chuan Lin & Lu
Internet	2004	Shih
Groupware Framework	2001	Kline
Hotel front office framework	2008	Kim et al
End-user Computing	2007	Wu et al.
Internet banking	2000	M. Tan & Teo
Shopping from the Internet	2000 2005	Ruth & Adviser-Arinze; Ahn et al.
Web-based electronic medical record	2004	Ross et al
Internet tax filing system	2005	Chang et al
Database management system	2000 2004	Venkatesh & Morris; Hasan & Ali
Word processor	1995 1996	Fred D Davis; Venkatesh & Davis

#### **3.1.4 The Application of the TAM to Test The Acceptance of E-books Among Higher Education Students**

Based on the extensive study conducted in the second chapter, most higher education institutions in developing countries are still struggling to overcome the difficulties facing the adoption of e-books (Woody *et al.*, 2010; Allen & Kaddu, 2014; Smeda *et al.*, 2015a). However, the study of the literature has also made clear that the rate of use of the electronic format of the printed books among higher education students in developed countries is still not satisfactory (Shepperd *et al.*, 2008; Chong *et al.*, 2009; Knutson &

Fowler, 2009; Nariani, 2009; Slater, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; de Oliveira, 2012; Roesnita & Zainab, 2013; Wiese & Du Plessis, 2014). There are two types of challenges facing the acceptance of the e-book. The first type represents the issues related to extrinsic factors. These challenges are either related to the e-book itself, i.e. C, M and F; or those related to the institution that is responsible for providing the e-book, such as universities, i.e. the LS and TS. This kind of challenge is very common in developing countries. The second type involves intrinsic factors such as RC and SE. Both developed and developing countries still suffer from these mentioned problems but at various levels. Most of the highly educated students in developed countries justify their non-use of the e-book to their unwillingness to change their reading habits.

According to subsection 3.1.3.2, the TAM is one of the most common theories that have been used extensively. The TAM has been recommended by many researchers for its ability to predict and explain users' behaviour towards the adoption of the technology. However, while there have been many studies on the adoption of the e-book, only a few researchers have used the TAM to explain the acceptability of the e-book (Letchumanan & Muniandy, 2013). Therefore, in the subsection below, related literature that uses the TAM to describe the acceptance of the use of the e-book is reviewed.

The study conducted by Smeda *et al.* (2015a) included the investigation of the factors affecting the acceptance of the e-book amongst MAS students at universities in Libya. The TAM was used and extended by using five factors that may affect the acceptance of e-book. Three of these factors belong to the category of extrinsic factors, which is related to the infrastructure of the universities and the characteristics of the e-book such as AC, TS and C; the other two factors are classified under intrinsic factors, which are related to the users or potential users, such as SE and SI. Based on the results, PU, PEOU and AU are the strongest factors at all. This study confirms that the TAM is a useful theoretical model to understand and interpret students' BI to use the e-book, where all the TAM constructs appear to have a significant impact on the acceptance of e-books among MAS students at universities in Libya. Moreover, both intrinsic and extrinsic factors are

important for predicting students' BI to adopt the e-book among MAS students at universities in Libya.

Ngafeeson and Sun (2015a) explored e-book adoption among undergraduate students in a campus in the Southern area of the United States. The investigation included 158 undergraduate students, who have used the technology of the e-book for learning in a southern USA university. The research examined the moderating role of personal innovativeness in the e-book on the TAM concepts. The results obtained in this study confirmed that the constructs of the TAM and the relationships are effective, reliable and applicable to measuring the acceptance of the e-book (Ngafeeson & Sun, 2015a). The study revealed that there is a positive moderating effect of personal technology innovativeness on the relationship between BI to utilise the e-book and the actual usage of e-book technology. These results showed that while people who are more familiar with technology (as well as those who are less techno-savvy), have a higher intention of using online instructional innovations such as the e-book, only the extremely innovative individuals may translate their intention to actual use. These findings have a critical impact on adopters, implementers, as well as the users of learning technologies (Ngafeeson & Sun, 2015a).

In 2015, (Wiese & Du Plessis) conducted a study to investigate learners' adoption and the application of the textbooks to allow libraries to make more informed decisions concerning their e-books collections. The electronic version of a textbook is classified as an e-book. The use of e-books as textbooks in education is a new paradigm (Embong *et al.*, 2012b; Marques de Oliveira, 2012). Wiese and Plessis gathered data from a classroom and surveyed learners who are aware of e-textbooks and had adequate experience using them. The researchers used a self-administered questionnaire to get the results among 254 respondents at the University of Pretoria for Marketing Management in South Africa. When the TAM was applied, the participants did not find academic e-books user-friendly, valuable and comfortable, in comparison to the printed textbooks. For that reason, academic e-books were not popular amongst these learners. The study interpreted this result as the need to emphasize on user-friendliness and also observed the practicality of this technology. Students need to realise that e-textbooks are not simply the electronic

versions of printed ones. E-books could offer students more benefits such as an interactive platform for participating in rigorous learning. These benefits need to be insisted on making sure that learners achieve the practicality of e-books. The study deduced that students need to be persuaded with regards to the helpfulness of e-textbooks in improving their studies and eventually their grades.

According to Ngafeeson and Sun (2015b), educational efforts in the past three decades have focused on the use of IT in education. Therefore, the second study by Ngafeeson and Sun (2015b) included the using of the IT in the learning process. The researchers perceived data frameworks both as proficient conveyors of the course material and a cost-effective instrument for enhancing student learning results, with the e-book as the best example. Administrators in academia ought to understand this technological revolution. Nonetheless, the acceptance of e-books by students has yet to reach its pinnacle, in spite of their increasing popularity in higher learning.

This study has used the model of TAM to explore students' acceptance of e-textbooks as "internal variables" affected by technology innovativeness and "external variables" impacted by system exposure. The findings reveal that students' technology innovativeness is related to their acceptance of e-textbooks and the exposure to this system is a significant moderator of the TAM constructs. These results imply that students' acceptance of new technology is expected to influence the acceptance of a particular new learning technology positively. Ngafeeson and Sun (2015b) further found out that exposure to the TAM model was a substantial moderator of TAM constructs. The study deduced that learners' technology innovativeness and system exposure should be considered in learning technology applications and related decision-making models.

Marston *et al.* (2014) examine the impacts of gender difference on the level of satisfaction and student adoption of e-textbooks (electronic version of the traditional book). They made use of the TAM system to explore students' adoption of e-textbooks. This study presented survey results collected from 250 male and female undergraduate students at the Mid-South University in the USA who used e-textbooks in their study. Its aim was to identify the potential differences between male and female students, with respect to their

satisfaction with e-textbooks. The results confirmed the existence of a difference between the genders in the possibility of the student's choice of e-textbooks as compared to printed books in the future. Although the results revealed that females use the e-book less frequently than males, the use of the interactive features of the e-textbook is more common among females. However, there is no sufficient evidence of the existence of gender differences with respect to satisfaction, PEOU and PU.

Lee (2013) explored aspects that resulted in the acceptance of the mobile e-book tool in South Korea. The study incorporated the dissemination of the innovation theory and the TAM with the model of technology resistance. He used this incorporated model in the setting of mobile and tablet mobile e-book acceptance by conducting a web-based appraisal. The findings of this survey demonstrated that individual innovativeness has substantial effects on PEOU and PU of mobile e-book technology. Additionally, both PU and PEOU influence, not just the participants' intention to use, but technology resistance as well. The study also recorded a substantial negative impact on technology resistance on the intention to use. The perceived risks of mobile e-books raised the issue of technology resistance among the participants.

Letchumanan and Muniandy (2013) studied the factors that have an effect on the future intention to utilise e-books among non-using, Mathematics students of Universiti Putra Malaysia. The researchers provided several vital practical inferences. First, PEOU and PU are pivotal predictors for non-users when it comes to creating a positive AU towards e-books. The study further showed that PU is a more noticeable factor towards e-books than PEOU. This study shows that PU is more crucial than PEOU, which means that developers should consider this factor when designing an e-book for learning. The noteworthy relationship between PEOU and PU reveals that user-friendliness is a crucial aspect of having the e-book as being effective. Relevant parties like e-book suppliers and library management should organise seminars to present e-books to non-users by demonstrating their PEOU and PU. The findings of this study proved that AU towards the intention to use e-books is one of the vital predictors of the motive for using e-books.

However, this model has the ability to explain only 25% of the variance (Letchumanan and Muniandy, 2013).

Sieche *et al.* (2013) investigated students' usage and acceptance of the e-book among Bachelor and Master students' in the program of a consecutive degree at the University of Hagen in Germany, based on theoretical considerations rooted in the Technology Acceptance Model (TAM). The results of this research confirmed the relationship between PEOU and PU on the one hand and students' AU toward e-books on the other. The external factors suggested by (Read, McQuilken, & Robertson, 2010) were examined, but the relationship between the emotional attachment to paper books and AU towards e-books was negative.

Letchumanan and Tarmizi (2011a) explored the motivation of using e-books as learning mediums among undergraduates in an Engineering division by employing the TAM and gender as its external determinant. The findings of their investigation demonstrated how PEOU relates positively with PU. PEOU has a substantial impact on AU and intention to use the e-book while AU has a substantial impact on the motive to use. Nevertheless, PEOU does not have a substantial impact on the AU towards using e-books. For this study, gender seemed to have no substantial impact on either PEOU or PU.

Using gender as a moderator, Ngafeeson (2011) conducted research on the acceptance of e-books among undergraduate students by using the application of the TAM. Gender difference has been tested through the investigation of the impact of moderating gender on the acceptance of e-books. An exploration of this area entailed research work focusing on information collected from 70 males and 88 females (undergraduate students in the USA). The results confirmed the reliability and applicability of the TAM when measuring the acceptance of the e-book. Although there is a general significance with regards to gender differences, there is insufficient evidence on the significance of gender differences in mutual relations between the TAM constructs. The results also indicate that despite the gender differences have been theorised and tested with different levels of empirical support; there must not be generalisations made when studying the gender effect on the use of technology.



In 2010, Bansal explored the role of personality in e-book application, environmental consciousness, the effect of preference for print books, as well as e-book design on the motive to utilise them. The exploration entailed research work centred on information collected from 115 e-book users from a Midwestern university in the USA, which validated the crucial findings. First, environmental consciousness affected the perceived navigational and visual designs of the e-book in a positive way. Ecological awareness also substantially decreased the students' fondness for printed books. Moreover, navigational designs and perceived positive visuals related positively to observed user-friendliness. A fondness for print books decreased the PU of e-books and their ease of use. The PU of the participants had a strong effect on the motive to continue using e-books in contrast to their PEOU. Lastly, the PEOU affected the PU of the e-book for the students in a positive way. These determinants also served as indicators of BI concerning the constant usage of e-books.

Nelson and Webb (2007) explored the views of students towards the e-book using the TAM concepts, internet usability factors such as the ease of searching and understanding, navigational simplicity, graphically amusing designs and computer unease. The study used 133 students registered in many sections of a preparatory MIS course at the University of Tampa, USA, that called for the usage of a web-based version of the textbook. The outcome showed how both the ease of learning and searching were the substantial indicators of PEOU and PU. The ease of learning and PU were also the substantial indicators of the application of similar e-books for future lessons. Nelson and Webb also emphasised that appearance; display design and navigation were vital aspects responsible for the effectiveness of e-textbooks.

Massive research concerning e-books has been concentrated on higher education institutions in developed countries (Lam *et al.*, 2009). Because most of the research countries do not suffer from the problems in the field of technical support or infrastructure, most of these studies have addressed the effect of intrinsic factors to accepting the e-book (Letchumanan & Tarmizi, 2010; Ngafeeson & Sun, 2015b) (Letchumanan & Tarmizi, 2011). Based on previous studies, it can be concluded that no studies have tested the

impact of the extrinsic and intrinsic factors upon the acceptance of e-books among higher education students in developing countries. Therefore, this research has covered this gap through the development of a theoretical model for the study of the influence of extrinsic and intrinsic factors to accept e-books among students in higher education in Libya.

## **3.2 Structural Equation Model (SEM)**

### **3.2.1 An Overview of the Structural Equation Modelling (SEM)**

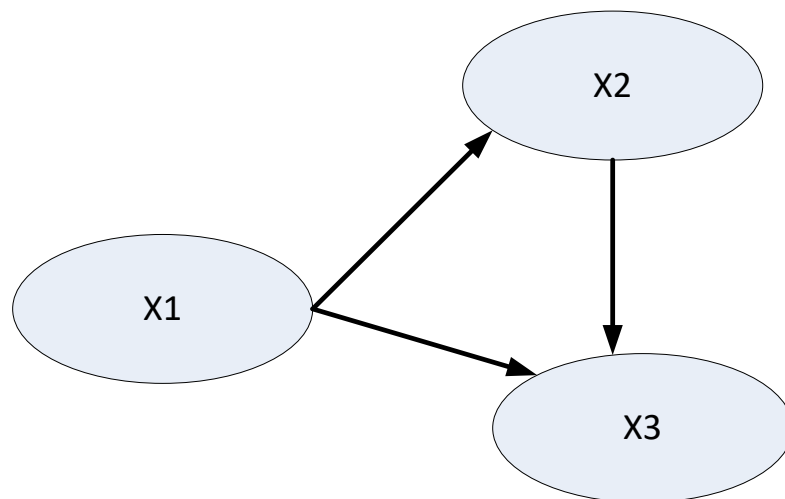
Structural Equation Modelling (SEM) is a technique of statistical modelling, used extensively in the Behavioral Sciences. It is a general term used to describe a significant number of statistical models that are commonly used to assess the validity of objectivity theories with experimental data. Golob (2003, p. 2) defines SEM as:

*“a modelling technique that can handle a large number of endogenous and exogenous variables as well as latent (unobserved) variables specified as linear combinations (weighted averages) of the observed variables. Regression, simultaneous equations (with and without error-term correlations), path analysis, and variations of factor analysis and canonical correlation analysis are all special cases of SEM. It is a confirmatory rather than exploratory method because the modeller is required to construct a model in terms of a system of unidirectional effects of one variable on another. Each direct effect corresponds to an arrow in a path (flow) diagram. In SEM one can also separate errors in measurement from errors in equations, and one can correlate error terms within all types of errors”.*

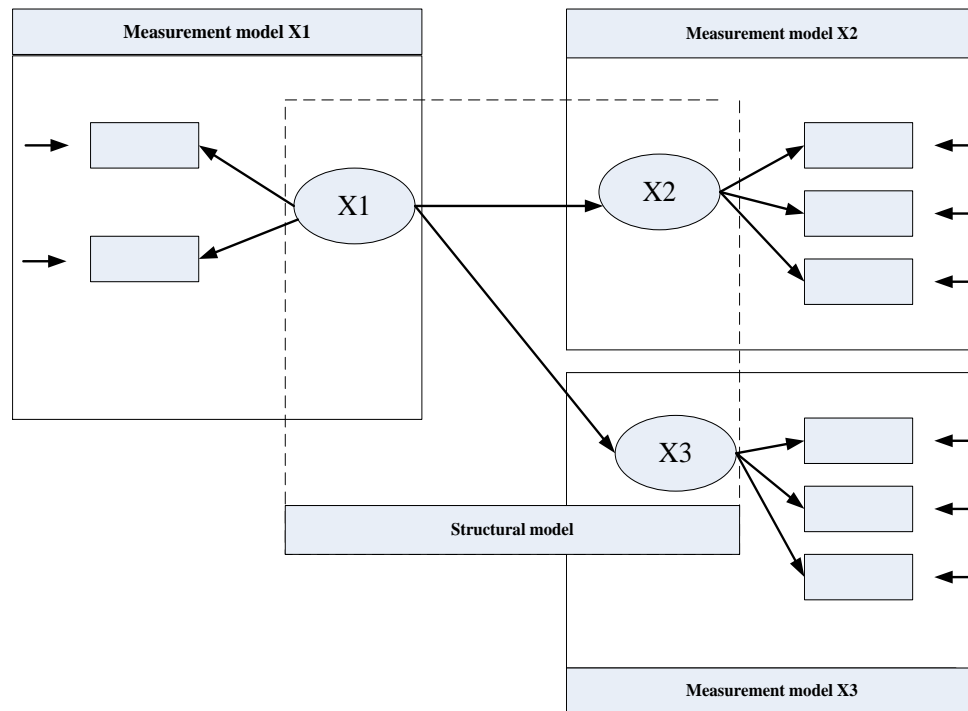
SEM is also known as LISREL models, meaning Linear Structural Relations, which was launched by Jöreskog on the first and most famous SEM programs (Hox & Bechger, 1999). The "Structural Relationship" is a general term that indicates the essence of the concept of SEM - dealing with relations between latent variables (Nachtigall *et al.*, 2003). Linear regression equations are usually used to formulate these relationships and are graphically expressed by path diagrams (Figure 3.4). SEM does not deal only with a single or multiple linear regression, but with the regression equations system, so it is considered flexible (Nachtigall *et al.*, 2003). Figure 3.4 shows the relationships between

variables X1, X2 and X3; where X1 has an impact on X2, X2 has an influence on variable X3 and X1 also has an effect on X3. SEM is different from ordinary regression analysis because it presents many equations simultaneously, where the same variable can be a predictor (independent variable) in one equation and a criterion (dependent variable) in another equation (Hoyle, 1995).

Sewall Wright (1921, 1934) has developed the path analysis methodology (Hoyle, 1995). This method was successfully used to calculate the direct, indirect and total effects of the factors. In Figure 3.5, the total effect of X1 on X3 can be calculated via the direct effect of X1 on X3 and the indirect effect mediated via X2. One of the most important features of SEM is its ability to deal with the latent variables, such as non-observable factors (i.e. the factors underlying the observed variables) (Nachtigall *et al.*, 2003). According to Edwards and Bagozzi (2000), the latent variables are associated with the observable variables by a measurement model. Figure 3.5 shows the SEM components, which consists of: (1) the structural model that represents the relationship between the latent variables; (2) the measurement model that represents the relationship between the latent variables and (3) the observable indicators (Nachtigall *et al.*, 2003).



**Figure 3.4: The Path Diagram Represents a Simple Linear Regression of X1 on X2 and a Multiple Linear Regression of X3 on X2 and X1, Written as a Path Diagram**



**Figure 3.5: An Expanded Model of the Regressive Dependencies between Three Latent Variables**

### 3.2.2 History of SEM

The history of the Structural Equation Model (SEM) identifies diversified and independent inputs. The theory of the research and development of models offers the basis for understanding and solving problems through statistical modelling. However, computerised structural modelling appears to be the foundation. The development of SEM cannot be attributed to a single person because it consists of many analytical approaches that are merged from different origins. These approaches have emerged from parallel efforts from scholars and have led to the development of SEM. It has been explained that the contributions from different and independent academic fields are significant to its development. In addition, SEM is a combination of many analytical procedures, a scope that explains its collective scope and possible roles of different scholars. Psychology, Sociology and Econometrics are some of the fields whose have made significant contributions to the

history of structural equation models. According to Schumacker and Lomax (2004); Bollen (2014), through the contributions of many scholars who were pursuing different analytical goals, the evolution of SEMs has identified three major breakthroughs that include path analysis, latent variable modelling and general covariance estimation methods (Schumacker & Lomax, 2004; Bollen, 2014). The significance of the three areas of breakthrough is discussed.

Unlike the general SEM that is a product of different inputs, the development of path analysis is attributed to a single person, geneticist Sewall Wright (1921, 1934). He established the three concepts, which are the covariance structure equations, the path diagram, that is also known as the causal graph, and a simplification of effects between variables into total, direct and indirect components (Golob, 2003). Despite earlier works by the scientist, the concept of path analysis remained unpopular until the second half of the twentieth century. Path analysis, before the year 1960, was not popular in many fields, including Biology, Psychology and Sociology (Shipley, 2000). In economics, the analysts relied on the identification of constraints on partial correlations to investigate causal relationships before the year 1960, but knowledge of path analysis was still lacking (Haavelmo, 1943). The lack of knowledge on path analysis among economists, according to Epstein (2014); Shipley (2016), undermined its use in the earlier period. The field of Sociology, through efforts by Blalock (1961), Boudon (1965) and Duncan (1966), discovered the path analysis concept after the year 1960 and extended the knowledge to partial correlation (Golob, 2003). Structural equation models then later emerged with features such as general covariance structure equations to replace the use of path analysis. Such covariance structures identified possible sequences of interactions between correlations. SEM, however, continues to rely on path diagrams in hypothesis identification in causal effect analysis.

The roots of SEM lie in path analysis invented by Sewall Wright, and even now, SEM analysis always starts with a path diagram (Wright, 1929). A path diagram is drawn using circles and boxes connected with arrows. Latent factors (unmeasured) are represented by circles or ellipses, and observed variables (measured) are represented by squares or

rectangles, and single-headed arrow paths are drawn to denote causal relationships (Byrne, 2013). Correlations and Covariances are denoted using double-headed arrows. A significant contribution of path analysis to modern SEM is the development of latent variable models that occurred in the 1960s. Covariances informed the models that improved the analysis of errors. Measurement errors and specification errors could be separated (Golob, 2003). Input from Blalock (1963) was fundamental and informed the development of the first general SEM through contributions from Jeoreskog (1970, 1973), Keesling (1972) and Wiley (1973). With these developments, however, path analysis could not investigate causal relationships until the efforts of Lawley (1940), Anderson and Rubin (1956) and Jeoreskog (1967, 1969) informed the development of the concept of maximum likelihood (ML) estimation methods for confirmatory factor analysis, which assists to the estimation of models through combining confirmatory factor analysis and path analysis. The estimation method of ML provided examining of individual direct effects and error-term correlations, Where it is still the most common method of appreciation used for SEM (Golob, 2003).

SEM was initially known as the Jeoreskog –Keesling–Wiley (JKW) model. Jeoreskog, both solely and in collaboration with other scholars, popularised SEM by the wide distribution of the linear structural relationships (LISREL) program. Currently, many SEM software programs became available (Golob, 2003) (see Table 6.3).

### **3.2.3 SEM Scope and Features**

SEM offers a convenient and general framework for statistical analysis through various multivariate procedures such as regression analysis, factor analysis, canonical and discriminant analysis (Hoyle, 1995). In SEM, the statistical model is represented in a matrix equation set. SEM consists of three models, two of which are elements of a measurement model, while one is a structural model (Golob, 2003). The measurement model consists of two sub-models, the sub-model for the dependent variable and the sub-model for the independent variable. The two elements of the measurement and structural models are approximated concurrently, but not all of them are always used in modelling. In most cases, either or both of the measurement sub-models are ignored. It is, however, important

to note that the SEM can have many dependent and independent variables. The composition of the SEM, in terms of the measurement and structural models, defines the types of SEM. SEM with latent variables is the first type, and the existence of all three models defines it. Another type of SEM is the SEM with observed variables where there is an absence of any of the measurement sub-models, while the last type is called the confirmatory factor analysis model and has measurement models but no structural models (Golob, 2003).

SEM also identifies causal effects of independent variables on dependent variables (Golob, 2003; Karadag, 2012), interaction effects of dependent variables and error-term covariances. The existence of dependent measurement models in SEM means that the corresponding structural model of the SEM has latent dependent variables instead of latent independent ones. This also applies to independent variables that can exist for both measurement and structural models of SEM. Simultaneous equations, path analyses and ordinary linear equations are special cases of SEM. Simultaneous equations and path analysis have real variables, while ordinary linear equations have single real dependent variables and multiple real independent variables (Golob, 2003).

The general scope of SEM, however, goes beyond the observable variables. It weighs the variables and expresses their values as latent variables. SEM models, however, differ from factor analysis in which such variables assume specific non-zero values (Gaskin, 2012) and an analyst predetermines the values of the latent variables (Golob, 2003). In addition, the non-zero variables that define the latent variables exist in linear models and explain the relationships between latent and real variables. A variation of the non-zero values, with optimisation objectives, informs an interpretation of the values. SEM offers the freedom to assign values to the factors, and these can be fixed to a single estimate for each factor, or each factor can be assigned a different value. SEM also allows for a specification of non-zero covariances between the observed and latent variables that enhance the analysis. Moreover, factor analysis can inform this. When using SEM, an analyst investigates different assumptions and compositions of a factor. With the existence of

multiple variables, many combinations of the measurement model can be derived with the help of factor analysis (Golob, 2003; Karadag, 2012).

Another key feature of SEM is the difference between direct and indirect effects that combine to define total effects. Direct effects exist in a model if a path can be defined by a variable and another that it affects (Lowry & Gaskin, 2014). A mapping exists for each direct effect and can be expressed diagrammatically. With a consideration of all possible direct effects in SEM, an identification of existing direct effects outlines SEM. This implies an identification of those possible direct effects that do not exist for SEM. (Gaskin, 2012). Changing paths, with the aid of available software, helps in identifying the available and absent direct effects for model definition and the identified direct effects establishes the causal aspects of SEM (Golob, 2003).

Unlike direct effects in which a path can be drawn between two related factors, some factors are related to significant intervening factors. These are called indirect effects and define effects that cannot be attributed to observable factors. They could emerge from unidentified sources or from the interaction among direct factors in a model. Total effects are the union of direct and indirect effects (Gaskin, 2012). Indirect effects may exist for a model, and they are grouped together before being factored in the total effects. The modelling of parameters for the paths of direct effects and significance of indirect effects, however, relies on covariance analysis and focuses on minimising deviations between variances and covariances of factors (Anderson & Gerbing, 1988; Golob, 2003; Karadag, 2012). The development of SEM, therefore, relies on an approximation of parameter values, subject to the condition that predictions are as close to the observations as possible (Golob, 2003). Covariance analysis, from this perspective, is a special case of least square regression. An existence of latent variables and non-recursive models, as well as an acknowledgement of error terms in covariances, are the distinguishing factors between covariance analysis and the least square regression (Anderson & Gerbing, 1988; Golob, 2003; Karadag, 2012).


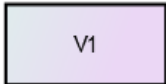


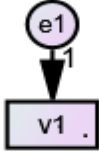
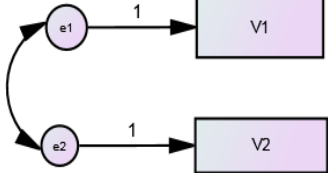
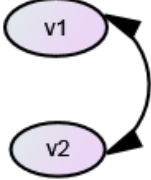
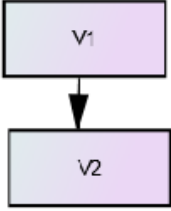
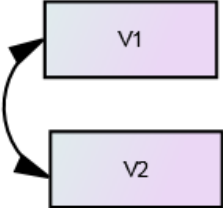
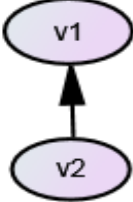
### 3.2.4 Path Analysis (PL)

Path analysis (PL) can be identified as a special case of SEM, where SEM extends PL by looking at the latent variables (Grapentine, 2000). PL is an extension of Multiple Regression; it allows for looking at more than one dependent variable at a time. It also allows for some of the variables to be dependent, with regards to certain variables and independent, in relation to some other variables. SEM path analysis methods are common in the field of Social Sciences because of the ease of getting results, where computer programs help researchers get the results without having to understand the experimental design, influence and sample sizes and many other factors that represent the methods to be followed for the design of good research.

PL usually starts SEM by drawing a path diagram. According to Hox and Bechger (1999), a path diagram is a diagram that shows the causal relationships between the variables in the model, which consists of the group of circles and boxes, linked by arrows. The measurement model consists of several variables. For example, the large oval shapes represent the model latent variables and the rectangle, or square boxes are used to describe the observed variables. Single-headed arrows or paths usually represent the causal relationships in the model, while the double-headed arrows indicate covariance or correlation. Table 3.5 describes the observed, latent variables and their relationships in path diagram.

**Table 3.5: The Type of Variables and their Relationships in SEM**

Diagram Symbols	Description
	Latent variables (v1)
	Observed variables

	Error (e1) associated with measured variables (v1) (residuals)
	The covariance of those residuals
	Covariance or correlation between two latent variables
	A causal relation
	A non-causal (unexplained) relation
	Direct relationship

### 3.2.5 Estimation Models and Sample Size Requirement

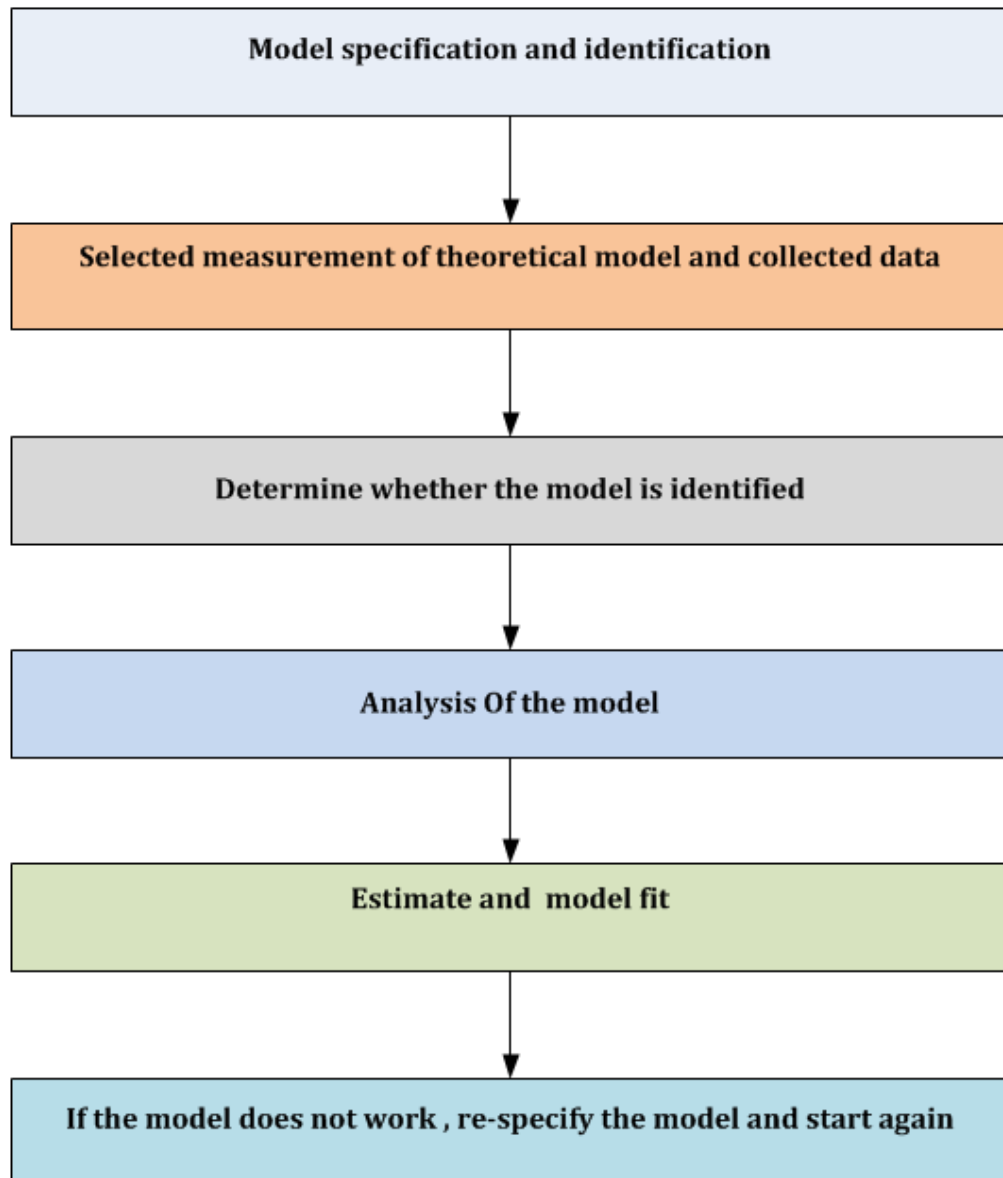
There are many methods that use SEM estimation, such as Maximum Likelihood Method (ML), Weighted Least Squares (WLS) and Generalized Least Squares (GLS) (Golob, 2003). These methods include a scalar fitting function that reduces the use of numerical methods. The matrices of the first and second derivatives of the fitting function are usually used to calculate the correlation and standard error of the parameters.

The result of the suitable optimal function and sample size must be the asymptotic chi-square distributed with degrees of freedom equalling to the difference between the number of free factors of the observed variance-covariance and the number of free parameters in the model (Golob, 2003). In SEM models, the data of variance-covariance are piling up, and hypothesis tests can be used to identify the extent to which each group is different from another group.

For the use of SEM, the required sample size must be appropriate and must meet the distributional assumptions (Nachtigall *et al.*, 2003). ML is most commonly used for the estimation of parameters, and it also calculates the model fit. Furthermore, it requires multivariate normally distributed continuous variables (Klein & Moosbrugger, 2000; Golob, 2003). The basic model in statistical modelling is  $\text{Data} = \text{Model} + \text{Error}$ . ML is used in this research as the estimation model. Nachtigall *et al.* (2003); Kline (2015) recommended that the sample size used to estimate the parameters should be more than 25 times the number of parameters, and the minimum being the subject parameter-ratio of 10:1. The minimum total sample size must be at least 200. In addition, the Weighted Least Squares (WLS) method presents a substitute, asymptotically approach of distribution-free (ADF), but the sample size should be exceptionally large, which is often unavailable in psychological research (Muthén & Kaplan, 1985; Muthen & Kaplan, 1992; Nachtigall *et al.*, 2003). For example, Young and Bentler (1994) suggest 2000 as a minimum sample size to provide satisfactory results. Generally, the accuracy and consistency of SEM outcomes decrease by increasing the sample size and the number of factors. Howell (1995) offers some advice on this subject.

### 3.2.6 SEM Analysis Processes

According to Walker (2012), the SEM analysis processes can be summarised into six stages. Figure 3.6 illustrates these stages, and each stage is explained later.



**Figure 3.6 The Steps in SEM Analysis Processes**

## **1 Model Specification**

The first step is to identify the model. This part of the analysis process should begin even before the data collection process. Proper conceptualization, operationalization and sampling are key sections of the first step (Walker, 2012). Theory and good sense must guide model specification. For example, the Technology Acceptance Model (TAM) is used to build the research model.

## **2 Selected Measurement of Theoretical Model and Collected data**

After building the model, the developed model is expected to be representative of the theoretical model and collected data. This step is very important as it represents the research method more than the statistics. In this research, ten external factors are added to the TAM to test the acceptance of e-books among MAS students at universities in Libya.

## **3 Model Identification**

The third step in SEM analysis is determined by whether the model is identified or not. Identification is a key in SEM. Identification addresses the issues of whether there are enough variables and whether they are distributed through the equations to estimate coefficients and matrices that are not known (Bollen & Long, 1992). There are three types of identification: just identified, over-identified and under-identified (Walker, 2012). The model of just identified is classified as not interesting. The over-identified allows for a testing of the theory. Moreover, this type of modelling is considered the required one for model identification. In particular, this is used when Multiple Regression analysis, like the model used in this research, is in place. The model of under-identified proposes that the model cannot be identified until re-specified or extra information is gathered. There are several tests that are usually used for the test of identification (Walker, 2012). The first manner is t-Rule, which offers necessary, but not sufficient conditions for identification. Although the model passes the t-Rule test, it may still not be identified (Walker, 2012). The Null B Rule is used in models that do not have a relationship between the endogenous variables. Contrary to the t-Rule, the Null B Rule offers sufficient, but not necessary conditions for identification. Similarly, the Recursive Rule is sufficient but does not have necessary conditions for identification (Walker, 2012). To be repeated,

there should not be any feedback loops between the endogenous variables. The Ordinary Least Squares (OLS) represents a good example of a non-recursive model, as long as there are no interaction terms included. The recursive rule does not assist in the establishment of building the identification for the models with a correlated error. The other test is the Order condition test. It hypothesises that the excluded variables from each equation must be at least  $p - 1$ , where  $p$  represents the number of equations (Walker, 2012). The last type of identification test is the Rank Condition test. This test is both necessary and sufficient, making it one of the best tests of identification (Walker, 2012).

#### **4 Analysis of the Model**

Analysing the model is the fourth step in SEM analysis. Contrary to the regression analysis, SEM uses more than one coefficient for each variable. SEM consists of a series of multiple regression equations that are fitted together (Walker, 2012). Solving these equations requires the use of matrix algebra, which greatly increases the complexity of the calculation and analysis operations (Walker, 2012). The matrices used in SEM are classified to the variance-covariance matrix and covariance matrix. These matrices are divided into four metrics of covariance and four metrics of coefficients (Golob, 2003). The matrices of coefficients can be identified as: (1) a matrix that relates endogenous concepts to each other ( $\beta$ ); (2) a matrix that relates exogenous concepts to endogenous variables ( $\gamma$ ); (3) a matrix that relates exogenous concepts to endogenous indicators ( $\lambda y$ ) and (4) a matrix that relates endogenous concepts to exogenous indicators ( $\lambda X$ ). First, the relationships between both endogenous variables and exogenous variables have been tested; the covariance among the variables must be subjected to testing. The test is accomplished through four of the covariance matrices, which are: (1) covariance among exogenous concepts ( $\Phi$ ); (2) covariance error for exogenous indicators ( $\theta\delta$ ); (3) covariance among endogenous concepts ( $\Psi$ ) and (4) covariance error for endogenous indicators ( $\theta\epsilon$ ). The output of  $R^2$ , standers error, B-coefficients and standardised coefficients in SEM analysis are similar to regression. However, in SEM, it is more complicated. In SEM, there are four different types of coefficients and four different types of covariance that should be dealt with. Due to the complexity of the interpretation, a full discussion of the SEM output is

not discussed in this research. Therefore, the basic equations in SEM are reviewed in this section. The first equation to test the structural model is:

$$\eta = \beta\eta + \gamma\xi + \zeta,$$

where:

$\eta$  is an endogenous (latent) variable;

$\beta$  is the coefficient of endogenous variables;

$\xi$  is an exogenous (latent) variable;

$\gamma$  is the coefficient of exogenous variables;

$\zeta$  is the error of endogenous (latent) variables.

The other two equations are used to measure the endogenous and exogenous measurement model that will be discussed in the next section.

$$X = \lambda_X \xi + \delta,$$

where:

$X$  is an exogenous indicator;

$\lambda_X$  is the coefficient from exogenous variables to exogenous indicator;

$\xi$  is an exogenous (latent) variable;

$\delta$  is the error of exogenous indicators.

$$Y = \lambda_Y \eta + \epsilon,$$

where:

$Y$  is an endogenous indicator;

$\lambda_Y$  is the coefficient from endogenous variables to endogenous indicator;

$\eta$  is an endogenous (latent) variable;

$\varepsilon$  is the error of endogenous indicators.

## **5 Estimate and Model Fit**

Different measures, based on the chi-square statistics, exist for evaluating goodness-of-fit and comparing models to identify the best among the groups of variables (Bentler, 1990; Bollen & Long, 1992; Gerbing & Anderson, 1992; Golob, 2003). The chi-square test relies on fitting functions within a sample. It measures the variation between the observed and expected values based on a hypothesis that no significant difference exists. If the null hypothesis is rejected at a level of significance, then a variation is assumed to exist between expectation and observation, rejecting possible fit. Even though the chi-square can also be used as a test statistic, a majority of professionals concur that it is better used in the evaluation of goodness-of-fit (Jöreskog & Sörbom, 1996). Such a use is based on the principle that chi-square must be below two degrees of freedom for a good fit to be achieved (Ullman & Bentler, 2003).

The components of a chi-square goodness-of-fit measure for a single model consist of Root Mean Square Error of Approximation (RMSEA) (Steiger and Lind, 1980), Z-test (McArdle, 1988) and expected cross-validation index (ECVI) (Browne and Cudeck, 1992). RMSEA determines the variation of degrees of freedom. Software exit can be used to calculate these values of the chi-square and their respective confidence intervals. A model is acceptable if its RMSEA is below 0.05 (Browne & Cudeck, 1992), especially its 90% confidence interval of 0.05 (MacCallum, Browne, & Sugawara, 1996).

Golob (2003) however, argues that with a direct comparison of a sample and its variance-covariance matrix, goodness-of-fit measures should include Root Mean Square Residual (RMR), the Standardized RMR (SRMR), the Goodness-of-fit index (GFI), the Adjusted Goodness-of-fit index (AGFI) and the Parsimony-adjusted Goodness-of-fit index (PGFI) (Mulaik *et al.*, 1989). SRMR should be below 0.05 for a good fit (Byrne, 2001; Steiger, 1990). The  $R^2$  value is another important measure of goodness-of-fit. It compares the error in variance with observed values, and its interpretation differs between reduced-form equations and structural equations (Golob, 2003).



## **6 If the Model Does Not Work**

If the model does not work, re-specify the model and start again. Ascertaining a goodness means the applicability of the model and not that the model is the best. This qualifies the model to be compared with other models, considering the assumptions of each model. In addition, the developed knowledge from a model analysis can inform post hoc analysis (Golob, 2003). The novelty of the analytical approach also depends on the availability of data on a subject matter (MacCallum *et al.*, 1996; Golob, 2003). For example, the development model can approve or reject a hypothesised model, but this should not restrict the analysis to the model, should it be approved. Therefore, it should be followed up by a further analysis, such as comparative analysis, to evaluate the model with other models and to improve the model at the same time (Golob, 2003).

### **3.2.7 Multi Regression Model and Path Model**

Although there are many types of models used by SEM, regression and path models are the most popular models used (Al-Mahdy, 2007). Regression analysis, also known as covariance analysis, is a multivariate approach and is used widely in many science fields such as in the field of Information Technology (Ahn, 2002; Al-Mahdy, 2007). It has a general scope that is wider than the scope of analysis of variance, and it considers multiple factors (Ahn, 2002; Bollen, 2014) in a single analysis. The multivariate scope of regression models identifies their strengths, especially because of the involved ease of developing the models and interpreting their results. For example, regression analysis can be used to evaluate the effectiveness of the use of the e-book. Many factors may exist for the effectiveness, and the regression analysis model allows a researcher to evaluate these factors simultaneously. An existence of indirect factors in relationships between variables, however, undermines the effectiveness of regression analysis models (Ahn, 2002). Employing SEM for the estimation of multiple correlations has various advantages. One of the most significant strengths of SEM is that complex path models can be estimated with the variables intervening between dependent and independent variables, as well as the latent factor (Schumacker & Lomax, 2004).

Another common type of model is the Path analysis model. It is an ancient model for investigating both direct and indirect effects, unlike the regression analysis model that is limited to causal relationships (Pedhazur, 1997). In addition, path analysis exists as a complementary analytical approach to regression analysis models (Ahn, 2002). It conducts additional regressions to initial regression analysis, to examine the effects of indirect factors and shows all the relationships together with a visual output (Ahn, 2002; Suhr, 2008). Path analysis is more complex than regression modelling and to simplify its application; path diagrams are used in the analysis and presentation of results. The model assumes a unit variance for all variables and compares the degree of direct and indirect effects of each variable (Ahn, 2002). The model also involves programming (Heckler, 1996). An understanding of the similarities and differences between regression and path analysis explains the choice for path analysis.

#### ***3.2.7.1 Similarities Between Regression and Path Analysis Models***

According to (Suhr, 2008), there are many similarities between the Path analysis method and traditional methods like correlation and regression. First, both models depend on linear statistical models. Second, the statistical tests used in both methods are correct if some of the assumptions are considered. The regression methods assume a normal distribution, while a multivariate normality is assumed by path analysis. Finally, neither approach provides a causality test.

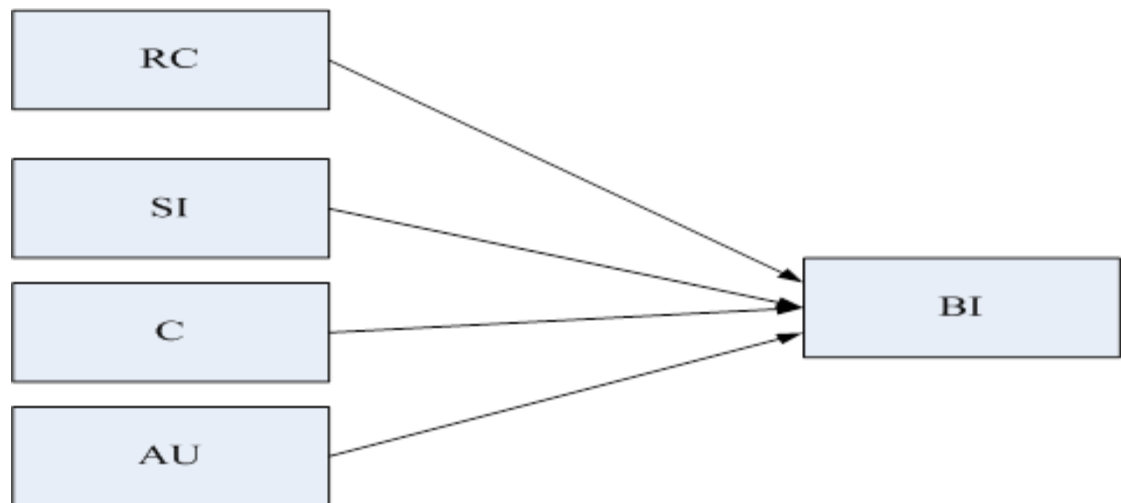
#### ***3.2.7.2 Differences Between Regression and Path Analysis Models***

Many differences exist between regression analysis and path analysis. One of the differences between regression and path analysis is the focus of analysis. Regression analysis focuses on direct effects only, unlike path analysis which focuses on both direct and indirect effects (Ahn, 2002), as shown in Figures 3.7 and 3.8. Path analysis is also able to distinguish direct from indirect factors in the analysis, an element that regression analysis lacks because of its limited scope. Path analysis is also more flexible than regression analysis, and it covers more factors than regression analysis (Suhr, 2008). This methodology would be suitable for achieving the accomplishment, economic trends, family and

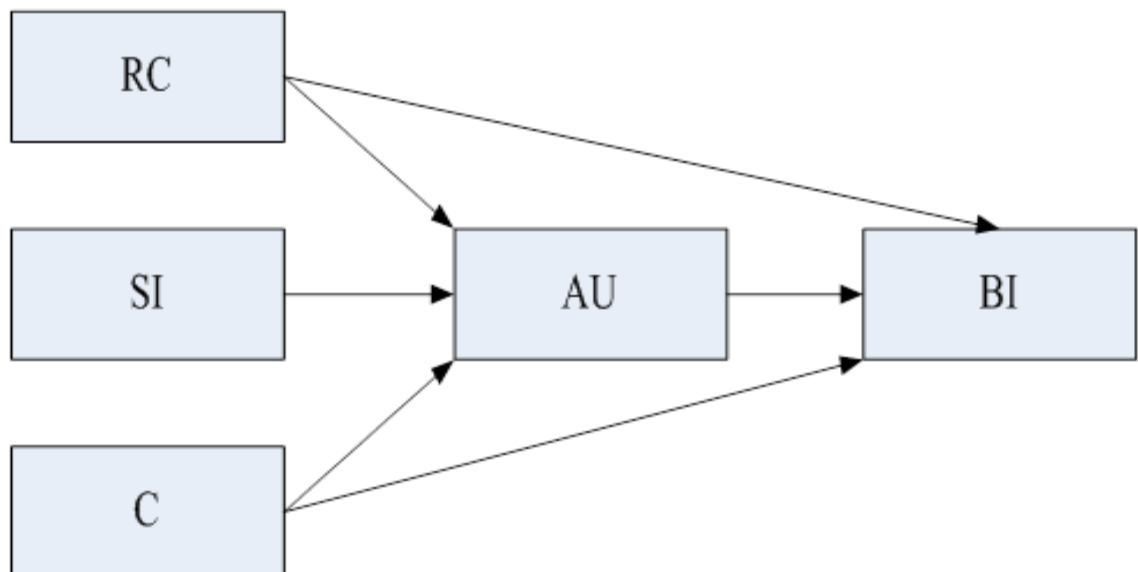
peer dynamics, health issues, self-concept, exercise, self-efficacy, depression, psychotherapy and other phenomenon (Suhr, 2008). Its complex scope allows it to evaluate the variables that regression analysis cannot explain. Model specification prior to analysis offers another difference between path analysis and regression analysis. While regression analysis stipulates a default model, path analysis specifies relationships in a model to be investigated and stipulates fewer limitations than regression analysis (Schumacker & Lomax, 2004). This distinction also explains the differences in their complexities. A stipulated default model can assume many values and be accepted, while a specified model has to meet the criteria for specified parameter values for approval (Suhr, 2008). In addition, the factors under path analysis can assume wider types because of fewer limitations, as compared to the requirements of regression analysis (Ahn, 2002). A researcher must also develop sufficient background information and theory for specifying relationships to be tested under path analysis because of the need to specify relationships before modeling. Based on its multivariate scope, path analysis can solve simultaneous equations (Suhr, 2008).

The nature of variables also distinguishes the two models. While variables in a path analysis can be dependent and independent, a regression analysis variable cannot be both dependent and independent within the same model (Suhr, 2008). A variable in a path analysis model can exist as both a dependent and an independent variable simultaneously, but this is not the case in regression analysis. In addition, path analysis recognises error terms, unlike regression analysis. A model is unlikely to be perfect, and factors such as errors and unexplained variances explain this, but regression analysis ignores such possible imperfections (Schumacker & Lomax, 2004). Simplicity in the determination of model fit is another basis for the difference between the two models. Regression analysis, for example, has tests for differences between data sets such as the difference in trends, relationships between variables and variation of data. Path analysis, however, does not offer specific statistical tests for goodness-of-fit. It requires a consideration of multiple tests such as chi-square, Comparative Fit Index (CFI), Bentler-Bonett Non-normed Fit Index (NNFI) and Root Mean Squared Error of Approximation (RMSEA). The significance of graphical representation for analysis and the interpretation of results in path analysis,

unlike in regression analysis, also identifies a difference (Suhr, 2008). In the analysis, the diagrams are modelled into equations whose solutions identify a suitable model.



**Figure 3.7: Regression Analysis Model**



**Figure 3.8: Path Analysis Model**

### 3.2.8 SEM Software Programs

Although the LISREL program was one of the first computerised programs that have emerged, other computer-based programs have been developed since the mid-eighties (Schumacker & Lomax, 2004). Currently, there are several programs available to researchers; each of them offering a distinct approach to handling the various modelling applications (Schumacker & Lomax, 2004). These programs can help researchers in the assessment process and test models and even generate an appropriate model that applies to the research data (Al-Mahdy, 2007). There is usually a trial version to train junior researchers (Student Version), and it can be obtained from the World Wide Web for free. Table 3.6 shows the most famous of these programs.

**Table 3.6: SEM software programs**

Program name	Developer name	Distributor name	References
LISREL –SIMPLIS, LISREL,PRELIS,IN, interactive LISREL	Karl Joreskog and Dag Sorbom (statistic department at Uppsala University)	The company of Scientific Software International E-mail: info@sscicentral.com Internet:http://www. sscicentral.co OR Lawrence Erlbaum Associates E-mail:orders@erlbaum.com Internet:http://www.erlbaum.com/	(Schumacker & Lomax, 2004; Al-Mahdy, 2007)
AMOS Program	Dr. James Arbuckle (psychology department at Temple University)	Small Watters Company E-mail: info@smallwatters.com Internet:http://www. smallwatters.com OR Lawrence Erlbaum Associates E-mail:orders@erlbaum.com Internet:http://www.erlbaum.com/	(Arbuckle, 1994, 1997)(Schumacker & Lomax, 2004)
EQS Program	Dr. Peter M. Bentler (psychology department at University of California)	Multivariate Software.inc E-mail: sales@mvsoft.com Internet: http://www. mvsoft.com	(Schumacker & Lomax, 2004)

### 3.3 Summary

This chapter is divided into two important sections. The first section discusses the historical development of the TAM that is used to predict and understand the acceptance of technology by users or potential users. From these models, the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM) are derived, widely used and mostly investigated (Ajzen, 1991). This section also focuses on the historical development of the TAM models in IT systems which include the Theory of Planned Behaviour (TPB) and Theory of Reasoned Action (TRA) models; which form the basis for the development of the TAM model. More explanations on the TAM model are provided, including aspects of adoption, validation and its extension. The limitations of the identified theories are also assessed, as well as the reasons for the selection of the TAM model. In seeking to explain students' acceptance of technology in education, this section mainly focuses on the acceptance of e-book technology. This section also includes previous studies that use the TAM model in order to study the acceptance of higher education students who use the e-book.

The second section includes a review of the Structural Equation Modelling (SEM) history. The features of SEM, estimating models and analysis processes have also discussed in this section. Besides, some models that are commonly used in SEM, such as multiple regression and path analysis models are reviewed. The last section of this chapter includes an illustrative table for the types of programs that are usually used by SEM.

## **4 Chapter Four: Methodology**

### **4.0 Overview**

Based on the findings of the literature review in the previous chapters, a proposed research model, and research hypotheses were developed for the present research to investigate the factors affecting the adoption of the e-book at higher education institutions in Libya. This chapter has covered the research methodology. The methodology is the tools or methods that can be used to achieve the objectives of any research successfully (Al-Aulamie, 2013). Several methods can be employed, such as descriptive, analytical, quantitative, qualitative, inductive, deductive, explanatory and confirmatory (Al-Aulamie, 2013). The researcher is keen to use the correct methods to achieve the research aims, which can be summarised in two aspects.

The first objective is to explore students' knowledge and experience towards using the e-book. The second aspect is to investigate the impact of factors on the acceptance and adoption of e-books among MAS students at universities in Libya. Therefore, this chapter discusses the research methodology used in this research. Besides, it provides a detailed explanation of the research framework and design. This chapter also addresses the design of the questionnaire through the pilot study. There are several steps involved in the research stages, such as research field study approval, a model for the e-book and human ethics approval. This chapter also describes the population sample, data collection processes and the processes of the data analysis.

### **4.1 The Research Framework**

During the past two decades, many researchers studied the adoption of technology as one of the important drivers in the development of education (Legris *et al.*, 2003). Researchers are keen to recognise the status or factors that determine technology adoption and usage (Legris *et al.*, 2003). Several models have been developed to explain technology acceptance. From these models, the Theory of Reasoned Action (TRA), the Theory of Planned Behaviour (TPB) and the Technology Acceptance Model (TAM) are derived

(Al-Aulamie, 2013). These models are most widely investigated into and used (Al-Aulamie, 2013). The acceptance of technology is constantly evolving due to the rapid advances in Information Technology (IT). Use and acceptance are two of the most important elements that contribute to the improvement of these theories and models that deal with the acceptance of technology (Al-Adwan & Smedley, 2013).

The TAM is a useful model that explains the behavioural intention of users in different IT applications (Al-Adwan & Smedley, 2013; Al-Aulamie, 2013). In 1986, Davis devised a model of Technology Acceptance that was based on the Theory of Reasoned Action (Davis, 1989; Davis, Bagozzi, & Warshaw, 1992). The TAM can evaluate the possibility and compatibility of the use of any information system (Fishbein & Ajzen, 1975; Masrom, 2007). The TAM performs the assessment of the behaviour of individuals that are likely to be affected by the use of information systems (Park, 2009). The TAM allows system designers to make changes in IT applications to improve their suitability for users to enhance its usability. Modelling of the TAM is an important body of research, and it is widely accepted in the field of IT (Al-Adwan & Smedley, 2013; Al-Aulamie, 2013).

This main aim of this research is to explore the factors that may have an impact on the acceptance of e-books amongst MAS students at universities in Libya. Therefore, the model of TAM was extended to develop a theoretical model used to achieve the research objective. The first group includes the TAM constructs such as Perceived Usefulness (PU), Perceived Ease Of Use (PEOU), Attitude (AU) and Behavioral Intention (BI). Seven of these factors belong to the first group, which are the extrinsic factors. Extrinsic factors are related to the infrastructure of universities, social factors and the characteristics of the e-book (i.e. Mobility (M), Accessibility (AC), Facilities (F), Technical Service Quality (TS), Library Service Quality (LS), Social Influence (SI) and Cost(C)). The other three factors are classified under the intrinsic factors, which are related to users or potential users (i.e. Self-Efficacy (SE), Language (LG) and Resistance to Change (RC)). Due to conflicting results about the impact of gender on the acceptance of the e-book (Letchumanan & Tarmizi, 2011a; Ngafeeson, 2011; Marston *et al.*, 2014; Yoo *et al.*,



2015), this research involves an investigation into the effect of gender differences on the acceptance of the e-book. Figure 4.1 shows the research framework.

These relationships in Figure 4.1 represent the research hypotheses (H1, H2, H3, H4.....H16). According to research in technology acceptance, the relationships between dependent and independent variables represent the hypotheses that governing the relationships between the variables of the model (Venkatesh & Davis, 2000; Lee et al., 2005; Cho et al., 2009; Park, 2009; Liu et al., 2010; Sánchez & Hueros, 2010; Al-Harbi, 2011; Lee et al., 2011; Udo et al., 2012; Padilla-Meléndez et al., 2013). The study of hypotheses allows for the exploration of each relationship between different technology adoptions variables in terms of the probability value such as the level of significance and standardised coefficient such as the expectation value. The hypotheses are specified as follows:

**H1:** Mobility has an influence on MAS students' Perceived Usefulness of the adoption of the e-book at universities in Libya.

**H2:** Accessibility has an influence on MAS students' Perceived Usefulness of the adoption of the e-book at universities in Libya.

**H3:** Facilities have an influence on the Perceived Usefulness of the e-book among MAS students at universities in Libya.

**H4:** Facilities have an influence on the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H5:** The Cost has an influence on MAS students' Attitude towards using the e-book at universities in Libya.

**H6:** The Library Services Quality influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H7:** Technical Service Quality influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H8:** Social Influence has an influence on MAS students' Attitude towards using the e-book at universities in Libya.

**H9:** Language influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H10:** Self-Efficacy influences the Perceived Ease Of Use of the e-book among MAS students at universities in Libya.

**H11:** Self-Efficacy influences MAS students' Attitudes towards using the e-book at universities in Libya.

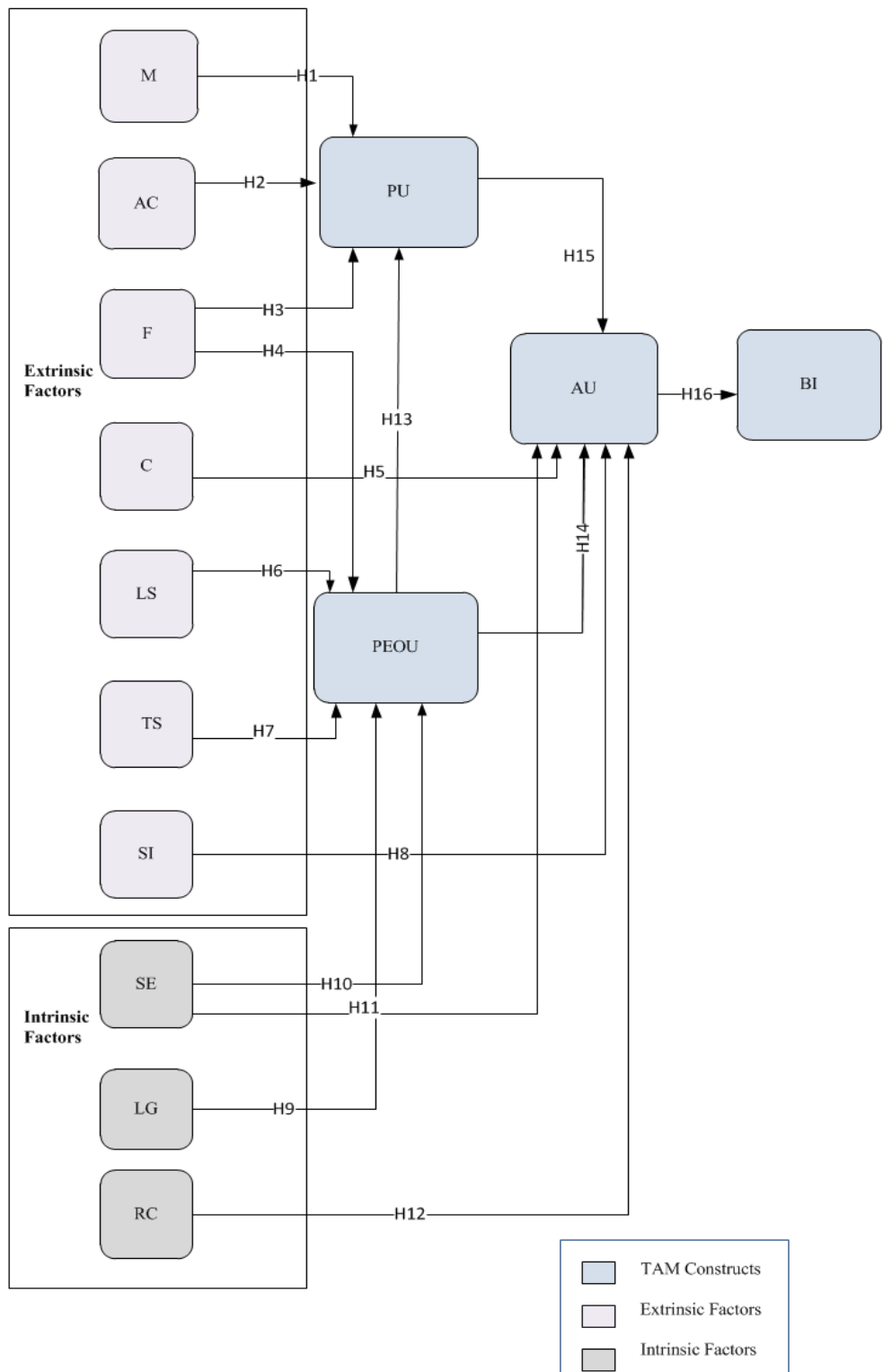
**H12:** Resistance to Change influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H13:** Perceived Ease Of Use influences the Perceived Usefulness of the e-book among MAS students at universities in Libya.

**H14:** Perceived Ease Of Use influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H15:** Perceived Usefulness influences MAS students' Attitudes towards using the e-book at universities in Libya.

**H16:** Attitude influences MAS students' Behavioural Intention to adopt the e-book at universities in Libya.



**Figure 4.1: Theoretical Framework**

## 4.2 Identifying the External Factors

According to previous research of technology acceptance, ten factors have been selected to measure the acceptance of the e-book. Venkatesh and Davis (2000) believe that the best method to determine the external variables is the review of literature because it provides a theoretical framework that can explain the relations between the variables of the model. The method of literature review can also assist in the development of a theoretical rationale for the causal relationships between the model variables, leading to the research hypotheses formulation (Al-Aulamie, 2013). The selection process undergoes two conditions (Al-Aulamie, 2013). First, the external factors should address the unique context of the e-book. Secondly, the external factors must have the ability to explain the acceptance of the e-book. The selected factors in this research came about after a thorough study of some experimental evidence and previous forecasts derived from existing literature.

According to Al-Aulamie (2013), the method of identifying the external factors have been used by many researchers as the standard in the technology acceptance research (Abbad, Morris, & Al-Ayyoub, 2009a; Abbad *et al.*, 2009b; Phan & Daim, 2011; Al-Aulamie, 2013; Alkharang & Ghinea, 2013b; Lee, 2013; Letchumanan & Muniandy, 2013; Marston *et al.*, 2014; Poon, 2014). Therefore, most researchers use a critical analysis of the literature to select the external factors that can be used in their research. External factors can be divided into intrinsic and extrinsic factors.

Davis *et al.* (1992); Venkatesh (1999); Yoo, Han, and Huang (2012) confirm that both intrinsic and extrinsic factors have a significant impact on individuals' adoption of IT. According to Yoo *et al.* (2012), research has begun to identify the factors that impact on users' acceptance of IT since the beginning of the computer era, for example in Davis's study (1989). Yoo *et al.* (2012) point out that the current literature has not been able to infer the role of external and intrinsic factors in the process of technology adoption. As a result, the literature often overestimates the impact of intrinsic factors in promoting e-books, while ignoring students' extrinsic factors that come from the technology itself or the users' environment. The possible reason may be that the constructs of TAM focus on the intrinsic factors. Previous research works have mostly concentrated on exploring

intrinsic factors (i.e. TAM constructs and personal innovativeness) and overlooked the importance of extrinsic ones, as noted when reviewing the literature in subsection 3.1.4. In fact, developing countries are still lacking in studies that combine the two types. In this research, the significance of identifying the extrinsic and intrinsic factors lie in the role that these factors play in strengthening the capacity of the model to explain the acceptance of e-books among MAS students at universities in Libya. Hsia (2007), Saadé et al. (2008) and Sánchez-Franco et al. (2008) note that the models that do not consider the impact of intrinsic factors face some difficulty in explaining and interpreting the motivational factors behind users' acceptance. Although most of the research has discussed the importance of intrinsic and extrinsic factors, they are still contradictory due to differences in the gender and research environment. There are many studies that support the importance of extrinsic factors more than intrinsic factors (Hsia, 2007).

The intrinsic and extrinsic factors can be classified into four aspects: (1) characteristics of the e-book; (2) the infrastructure of the universities; (3) users or potential users' characteristics and (4) the social factor. The literature has pointed out that these aspects could forecast and explain the TAM constructs, such as PEOU, PU, AU and BI in the research of the information system. The characteristics of technology play an important role to determine the acceptance of users in various fields of information systems (Venkatesh & Davis, 1996; Al-Aulamie, 2013). Therefore, several studies have examined some factors related to system characteristics, pointing to their importance to predict and explain the acceptance of instructional technology (Pituch & Lee, 2006; Park *et al.*, 2009). Despite the fact that the effect of the factors of system characteristics on the acceptance of e-books by users have not been fully tested (Pituch & Lee, 2006; Al-Aulamie, 2013), Venkatesh and Davis (1996) assume that the variables of technology characteristics have a direct effect on users' BI.

The availability of the infrastructure provided by the educational institutions involved is one of the important aspects to determine the acceptance of instructional technology (i.e. technical service and support) (Williams, 2002; Abbad *et al.*, 2009b). The common factors that are used in the present research are TS and LS. Several years ago, Borchert *et*

*al.* (2009) confirmed the impact of technical service problems such as infrastructure and e-book technology service in the use of the e-book. Folb *et al.* (2011) point out that LS represents the significant factor in the adoption of the e-book by students, where they recommended libraries to improve the level of their services such as engaging in active encouragement, instructional activities and the development of e-book discovery tools that can facilitate the use of the e-book by the students. The results obtained confirmed that technical and library services are very significant to determine students' acceptance of the e-book.

The characteristics of users' or potential users' factors appear to have a significant impact on students' acceptance of the e-book (Pituch & Lee, 2006). According to Heinich (1996); Franklin and Plum (2004); Levine-Clark (2006); Grudzien and Casey (2008); Nicholas *et al.* (2008), the factors associated with the characteristics of the users is one of the most important factors that play a major role in influencing the use of e-books. Therefore, the present research has used the characteristics of the users to evaluate students' perception toward the adoption of the e-book.

Social factor is one of the most important factors that have a substantial impact on technology adoption. According to Ahmad (2015), one's intention or tendency to use technology can be influenced by the factor of social influence, i.e. the influence of peers, colleagues or teachers. Lin *et al.* (2010) also confirmed the impact of the recommendations of peers, colleagues and experts on students' BI to use the e-book for academic purposes. Thus, due to the importance of these aspects in determining students' acceptance in many areas of IT generally, especially e-books, the researcher has decided to use them to evaluate the acceptance of the e-book among MAS students at universities in Libya.

#### **4.3 Definition of the Factors that Were Used to Develop a Theoretical Model**

The most prominent objective of this research is to investigate the factors that have an effect on the acceptance of the e-book among MAS students at universities in Libya. In

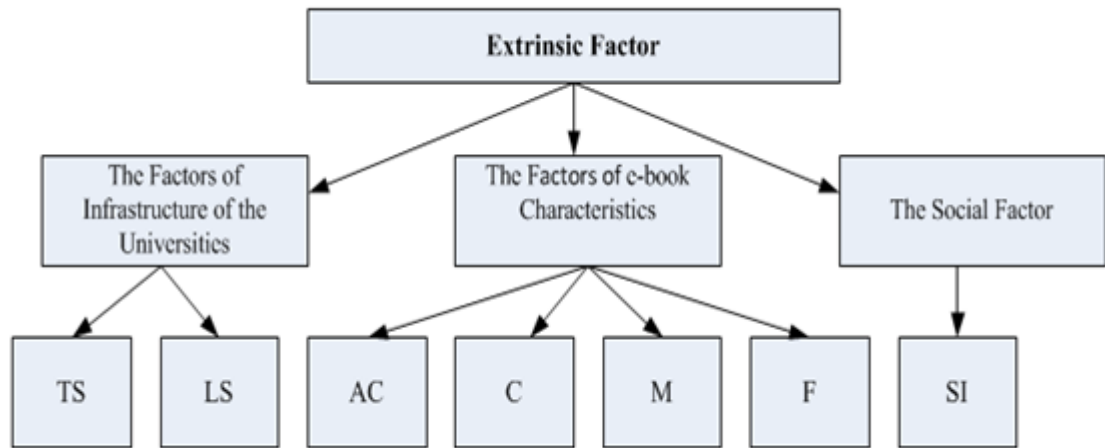
achieving this goal, a theoretical model has been developed through the addition of the intrinsic and extrinsic factors to the TAM model. As mentioned in section 4.2, the factors used in this research were selected based on a thorough study of some experimental evidence and previous forecasts derived from existing literature. This section presents a review of some of the literature that has used these factors, either in the area of the e-book or in the field of education technology in general. As mentioned in section 1.2 and 1.3, studies that conducted to investigate the acceptance of the e-book are relatively few (Letchumanan & Tarmizi, 2011a; Jin, 2014). Therefore, some of the factors identified in this research were not used previously in the measurement of the acceptance of the e-book. Nevertheless, the researcher used the literature in other fields of education technology to support the importance of these factors.

Referring to the research in technology acceptance, the relationship between dependent and independent variables represents the hypotheses governing the relationships between the variables of a model (Venkatesh & Davis, 2000; Lee, Cheung, & Chen, 2005; Cho, Cheng, & Hung, 2009; Liu, Liao, & Pratt, 2009; Park, 2009; Sánchez & Hueros, 2010; Al-Harbi, 2011; Udo, Bagchi, & Kirs, 2012; Lee, Hsieh, & Chen, 2013; Padilla-Meléndez *et al.*, 2013). The study of the hypotheses allows the exploration of each relationship between different technology adoption variables, in terms of the probability value such as the level of significance and standardised coefficient such as the expectation value. This strategy is widespread in deductive studies, where researchers initially propose to test the studies' hypotheses. The next few subsections provide the definitions of the factors that have been used in the construction of the theoretical model, where previous research was used to demonstrate the importance of the selected factors.

#### **4.3.1 Extrinsic Factors**

Extrinsic factors reflect external control or the impact of self-regulation (Yoo *et al.*, 2012). Eshetu (2015) indicates that the extrinsic factors include ICT technology availability, technical service, social influence and accessibility. This subsection discusses some factors related to the characteristics of the e-book, infrastructure of universities and social factor. Figures 4.2 illustrates the selected extrinsic factors of the theoretical model

that are divided into three groups which are the factors of e-book characteristics, the factors of the infrastructure of universities and the social factor.



**Figure 4.2: Extrinsic Factors Group**

## **The Factors of e-book Characteristics**

### **4.3.1.1 Mobility (M)**

Mobility (M) can be defined as the ability to enter and search any place at any time without any restrictions, by using e-reader devices (Walton, 2013). E-book readers are devices that facilitate the reading of e-books, and they are referred to by a number of names; for example, mobile reading devices, e-readers, e-book readers and devices for reading on the go, etc. (Drinkwater, 2010; Kumbhar, 2012). There are many types of mobile devices such as smartphones, laptop computers and tablets that can be used to read e-books. These are usually small and portable and have a display screen that can accept touch input and/or input from a small keyboard.

Simon (2002) demonstrates that students in the area of Biology enjoyed using e-books because of the advantage of mobility when using electronic reading devices. The factor of M is a strong motivation for students to use e-books because it enables access to other digital resources and provides the ability to search quickly (Choi, 2012; Peek, 2012).



However, Noorhidawati and Gibb (2008) confirm that the lack of M is a major cause for the non-use of the e-books. Based on the study that was conducted by Berglund *et al.* (2004) to understand the viewpoint of faculty and library members, one of the most important factors that have a negative impact on the acceptance of e-books is M. Khanh (2014) in South-Korea investigated into the adoption of smartphones and mobile devices for learning among undergraduate students at a Vietnam university using the TAM model. Based on the results of this study, the mobility factor does not have an influence on the PU. It is one thing to say that an awareness of mobility for usefulness is a truism, especially in a developed society like South Korea. According to Foote and Rupp-Serrano (2010), the major obstacle that prevents students from choosing to use e-books is M. Based on the importance of this factor, its impact on the acceptance of the e-book among MAS students at universities in Libya was studied.

#### **4.3.1.2 Accessibility (AC)**

Accessibility (AC) is the degree to which the e-book is available to as many students and teachers as possible (Wixom & Todd, 2005). Also, it can be viewed as "*the degree of convenience with which an individual accesses an information system*" (Park *et al.*, 2009, p. 199). The ability to gain access to e-books anywhere and anytime is very attractive to students (Walton, 2013). According to (Letchumanan & Tarmizi, 2010), the point of access to e-books can be a strong motivation for potential users to adopt the e-book. They explained that accessibility attracts a number of students to adopt e-books as a source of learning. Therefore, it is confirmed that students from the West of England University in the UK typically have a preference for e-books and the availability feature was the most attractive factor that encouraged them to use e-books (Chelin *et al.*, 2009).

A study of two Queensland Universities in Australia indicated that the users are well aware of the characteristics of the e-book (Borchert *et al.*, 2009). The most popular feature of e-books is AC. Therefore, users of the e-book are growing gradually, largely owing to the accessibility feature. Based on the TAM, Thong, Hong, and Tam (2002) identified nine factors in a study of users' acceptance of digital libraries and AC was one of the most important of these factors. The obtained results confirmed that accessibility was one of

the most influential factors on PEOU, while the factor was insignificant towards PU. The results obtained was supportive of all the results which confirm the importance of AC. Consequently, AC was subjected to measurement in this research.

#### **4.3.1.3 Facilities (F)**

Facilities (F) are the use of the tools and functions of the e-book to clarify the contents of the e-book for users (Mustafa *et al.*, 2014; Smeda *et al.*, 2014). The characteristics of technology have a direct effect on users' acceptance of different applications of the e-book (Hong, Cheng, & Liao, 2005). Simon (2002); Roesnita and Zainab (2013) reports that users prefer some e-book features such as bookmarking, the ability to highlight glossary lookup and annotate. Also, (Shelburne, 2009) identifies e-book features in the provision of search facilities that have contributed to raising the proportion of the use of e-books at the University of Illinois Library in the USA. According to Chong et al. (2009), students like the facility to highlight, bookmark, link between pages, draw notes, link from the table of contents, annotate the e-book, as well as a link from the index. Additionally, students prefer e-books consisting of pages and figures that contained a clean, consistent, tidy layout design and reliable navigational tools. Furthermore, the e-book provides interactive dictionaries that facilitate users to choose any word within the e-book and get a description instantly, look up an immediate translation to another language or have the definition read aloud (Cavanaugh, 2002; Stone & Baker-Eveleth, 2013). Moreover, the e-book allows for updates on a monthly, weekly or daily basis, which can be helpful for courses based on technology or for those related to current affairs. De Diana (1991); Lai and Chang (2011) assume that annotation and demarcation are key components in making e-books an attractive alternative to printed books. These can be improved with an extensive range of different types of media such as audio, video, animated materials, etc. to assist in the learning process (Rao, 2004).

Anuradha and Usha (2006) carried out a survey regarding users' perspectives about the possibility of the use of e-books at the Indian Institute of Science. Many reasons have been submitted to justify the use of the e-book. For example, 71.66% of respondents have reported that the search tools to determine the words or quotes are the main reason for

using the e-book, 50% of respondents have admitted that the mobility and multimedia were the motives behind the use of the e-book, while the e-book features attracted 41.66% of respondents.

Based on the study of the future of the e-book in the field of research conducted by Romero-Otero, Iglesias-Fernández, and Giménez-Toledo (2014), the majority of respondents have shown optimistic attitudes towards using the e-book in the research area. The F provided by the e-book was the primary factor that helped the users in their research. Due to the importance of this factor, it has been selected to participate in building a theoretical model in this research.

#### **4.3.1.4 Cost (C)**

Cost (C) includes the purchase of electronic reading devices such as e-book readers, tablets, software used and electronic publications (Zinn & Langdown, 2011; Smeda *et al.*, 2014). Technology is considered an important factor, which is built on the basis of the idea of electronic education in developing countries (Rhema & Miliszewska, 2010; Rhema, 2013). Unfortunately, it is very expensive, unexpected and can become stale. This makes the initial costs of buying computers or other e-reader devices and the costs of updating the systems very high (Alwani & Soomro, 2010; Rhema & Miliszewska, 2010; Rhema, 2013; Sim *et al.*, 2014).

In the case of the e-book, Sim *et al.* (2014, p. 1) emphasise that “*in developing countries, e-books are still too limited to the top university libraries, and e-readers have yet to expand too expensive and too limited to users*”. According to Sim *et al.* (2014), the price can be an obstacle to the use of the e-book. For example, some e-readers (i.e. Nook, Kindle, Nobo) are not available in Malaysia and Philippines. Therefore, it is purchased online and shipped to these countries. In these cases, the user will have to pay additional expenses, in the form of shipping charges, and thus, may not be able to afford it. In an economically stratified society, the costs are affordable for the middle and upper economic levels, but out of financial range for the lower levels (Sim *et al.*, 2014). Moreover, Cavanaugh (2004) confirms that C is the important reason for students to adopt and use the e-book. In addition, the study conducted by Zinn and Langdown (2011) in South

African universities showed that the cost of the hardware needed to read an e-book, formats and the contents of the e-books represent a real obstacle to the use of e-books in South Africa. Borchert *et al.* (2009) also report that 43% of the students involved in the questionnaire used at Griffith University and the University of Southern Queensland in Australia have chosen the factor of cost when asked about the reasons for disliking the e-book.

However, educational professionals consider that technology, mainly e-book technology, presents the chance to concurrently lower educational expenses and enhance student accomplishment (Leaf, 2003). For instance, according to Vedder et al. (2010), a number of textbook publishers now present their products in an electronic system, frequently at a portion of the price of printed adaptations. Turner (2005) indicates that eight colleges in the USA were able to provide e-books for students at a price 33% less than the normal price. These colleges are Morehead State University, Princeton University, California State University at Fullerton, Bowling Green State University and the University of Oregon, Utah, Georgetown College in Kentucky. Nevertheless, Epstein (2005) confirmed that colleges must provide the cheapest options for students. Therefore, the C is often mentioned in the literature as one of the most important barriers to electronic education in general, specifically the e-book (Ali & Magalhaes, 2008; Sim *et al.*, 2014). The cost savings related to e-book production can be conceded to students in the appearance of low-priced books. Therefore, this research has investigated the importance of cost towards the acceptance of e-books among MAS students at universities in Libya.

#### **4.3.1.5 Technical Service Quality (TS)**

Technical Service (TS) is defined as the level of necessary ICT provided to support the education process (Leaf, 2003). Abbad *et al.* (2009a, p. 5) identify TS as “*people assisting the users of computer hardware and software products which can include hotlines, online support service, machine-readable support knowledge bases, faxes, automated telephone voice response systems, remote control software and other facilities*”. The availability of TS is one of the most significant aspects in determining the recognition and approval of technology for learning (Williams, 2002). The availability of technical service of internet

services has increased the opportunity for easy access to e-books and digital resources on the web (Walton, 2013).

TS problems are shown as an external factor that has a major effect on education technology projects (Abbad *et al.*, 2009). For example, according to the comments obtained in the survey conducted by Leaf (2003), the students complained about TS problems. These problems include failure of systems, where the system usually collapses for long periods as it is unable to bear the pressure. Others have the problems of accessing and using the search functions. Also, some computers in the college do not have the necessary reading programs such as the Acrobat Adobe Reader.

Moreover, Buabeng-Andoh (2012) reports that inadequate TS plays a huge role in the non-use of technology in teaching. An excellent example of the importance of this factor can be seen in the study of Abbad *et al.* (2009a) in Bahrain. They used TS as the independent factor to extend the TAM to investigate users' acceptance of the electronic education system. The outcomes confirmed that TS has a significant direct influence upon PEOU and PU of students using the education system. However, Abbad *et al.* (2009a) tested the impact of TS on the adoption of e-learning in Jordan. The results of this study were somewhat different from previous studies. Not only does TS have an insignificant impact on PEOU, but it also has a weak indirect effect upon the intention to use an e-learning system. Otherwise, it significantly influences PU. Based on the significance of this factor, it was chosen to measure the acceptance of e-books among MAS students in Libya.

#### **4.3.1.6 Library Services Quality (LS)**

Library Services Quality (LS) is referred to the quality of service that is provided by academic libraries for teachers and students to locate and use e-books (Perry, 2005). It also refers to the reliability and efficiency, security and content quality of e-books that are provided by digital libraries (Khanh & Gim, 2014). Many universities around the world are early adopters of e-books, where they have been provided with numerous opportunities to enhance electronic access for their users (Walton, 2013). For example,

approximately 95% of academic libraries in the USA provide e-book access to support educational learning (Walton, 2013). As mentioned in subsection 2.2.7, the lack of library services in some universities or weakness in others in developing countries is the primary cause for not preferring e-books as a learning source by numerous users (Elkameshi, 2012; Rhema, 2013; Al-Tarras, 2014). According to a survey conducted by Roesnita and Zainab (2013) of fourteen academic library's websites in Malaysia, e-book services are provided by only six academic libraries such as the International Islamic University Library; Universiti Utara Malaysia; University of Malaya Library; Universiti Sains Malaysia; Open Universiti Malaysia and Universiti Tun Abdul Razak. There is not enough information on the current status of the e-book service in these libraries.

E-books should be easily accessible via the catalogues of libraries (Dinkelman & Stacy-Bates, 2007). Although several academic libraries have websites which are linked to the libraries online catalogue (that allows users to access and find e-books), many of those catalogues are poorly designed for e-books search (Dinkelman & Stacy-Bates, 2007). Dinkelman and Stacy-Bates (2007) discuss that the terms used to identify e-books in the catalogues are non-standard and confusing, which hinders students' ability to identify, access and use the e-books. In essence, students might desire to use an e-book, but academic libraries are doing a poor job of enabling students to find them. Results of the studies conducted by Roesnita & Zainab (2013) and Dinkelman & Stacy-Bates (2007) stress the importance of the services provided by the libraries in the use of the e-books. Consequently, the factor of LS was chosen to test the acceptance of the e-book in this research.

#### ***4.3.1.7 Social Influence (SI)***

Social Influence (SI) is the subjective norm (Yau & Ho, 2015). The term, 'Social Influence' or 'subjective norm' was introduced in Social Psychology research dating back to the mid of the 20th century (Yau & Ho, 2015). According to Eckhardt (2009), this term is used to refer to the influence of communication that takes place between individuals, which leads to a change of emotion or mood or view of a person or an individual associated with a particular behaviour. Hashim (2011) views that Social Influence can significantly influence the BI of individuals to comply with the views presented to them.

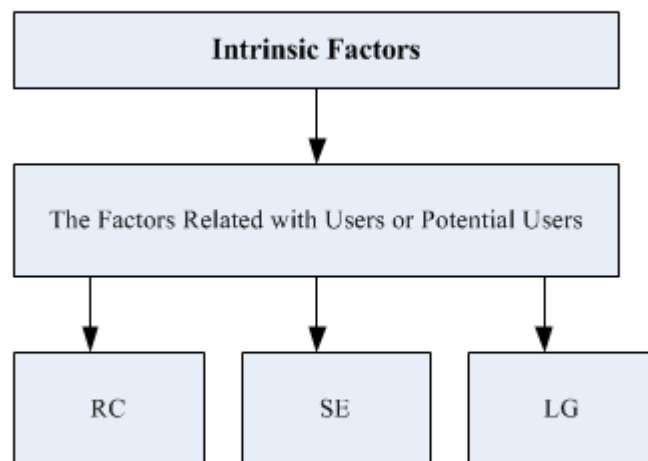
Furthermore, it is suggested that individuals act or exhibit a particular behaviour, despite their non-acceptance of the positive outcome of the behaviour enforced through the influence of another person or an individual. The individual behaviour is motivated by the views presented by one or more references, and his or her behaviour is simply to comply with their views. According to Lu *et al.* (2003), SI is defined as an individual's belief that it is significant for other individuals to engage in an activity. Social Influence is studied in both TRA and TPB as the important determinant to explain the adoption of a system (Rao & Troshani, 2007).

Several studies have documented the impact of SI on BI (Mathieson, 1991; Taylor & Todd, 1995a; Pavlou & Chai, 2002; Rao & Troshani, 2007; YANG, 2007; Jong & Wang, 2009; Özer & Yilmaz, 2011; Pookulangara, Hawley, & Xiao, 2011; Tarhini, Hone, & Liu, 2013). Ghyas, Sugiura, and Kondo (2012) report that the factor of SI has a positive influence on the adoption the e-book readers in Japan. They justified that the social culture in Japan is often strong. As such, it makes sense to find a positive relationship between SI and BI to buy or use e-book readers. Fan et al. (2005) argue that a user would be more likely to suggest and recommend a mobile service to others if he or she is satisfied with the service. According to Tarhini *et al.* (2013), the findings indicate that SI has an important impact on students' BI to use e-learning in developing countries. Similarly, Schepers and Wetzels (2007) confirmed that SI is a significant determinant of PU and students' BI.

On the other hand, Koeder, Mohammed, and Sugai (2011) do not agree with the results obtained by Ghyas *et al.* (2012). Their results explain that SI is negatively correlated with the BI of e-book readers in Japan. Also, van Raaij and Schepers (2008) posits that the factor of SI has an indirect impact on the BI to adopt the e-learning system at the Bahrain University. Moreover, to understand how teachers accept the technology of the e-learning system, Allan studies the effect of some factors such as SI on teachers' BI to use e-learning. The results find that SI is significant and powerful in predicting PEOU and PU of e-learning. Otherwise, the impact of social influence on the BI of users is insignificant. The consequence, the SI factor, has been subjected to the test.

#### 4.3.2 Intrinsic Factors

Yoo *et al.* (2012) identify the intrinsic factors as the factors that reflect the natural human propensity to learn and absorb. Intrinsic factors are associated with the user himself, such as the extent of his understanding of the technology used, perceptions including the intent or motivation of using ICT and technology self-efficiency, beliefs and his attitude towards technology which may conflict with the application of ICT (Eshetu, 2015). This subsection focuses on the factors related to users' or potential users' characteristics. Figures 4.3 illustrates the selected intrinsic factors of the theoretical model that are divided into three factors.



**Figure 4.3: Intrinsic Factors Group**

##### 4.3.2.1 Self-Efficacy (SE)

Self-Efficacy (SE) is a significant concept in the theory of social learning (Bandura, 1977). SE is the belief of an individual in his/ her ability to carry out particular behaviours



or one's individual beliefs regarding his/ her capability to carry out particular tasks successfully (Compeau & Higgins, 1995; Compeau *et al.*, 1999; Al-Ammari & Hamad, 2008; Abbad *et al.*, 2009b). It is also described as a personal judgment that is apprehensive, not with the skills that one possesses, but with judgments of what one can perform with whatever skills one possesses (Bandura, 1986). Therefore, SE is described as the perception of an individual regarding his or her capability to make use of e-book devices such as computers in the completion of a task (Compeau & Higgins, 1995). Similarly, SE of e-book readers is interpreted by a student's self-confidence in his/ her capability to make use of e-reader software and devices, such as personal computers, tablets and smartphones (Letchumanan & Muniandy, 2013; Waheed *et al.*, 2015). A student who possesses a keen sense of his ability in dealing with e-reader devices might have a more optimistic perception of its usefulness and ease of use, and it is possible to be more willing to use and accept e-books.

Literature shows that the relationship between Self-efficacy and the adoption of technology in education is a statistically significant relationship (Burkhardt & Brass, 1990; Hayashi *et al.*, 2004; Waheed *et al.*, 2015). According to (Vijayasathya, 2004), computer SE, with regards to the computer, has a strong influence on BI to use the online system, because it will remove the concerns, especially those related to the loss of personal information. Al-Ammari and Hamad (2008) extend the TAM to study the use of the e-learning system in Bahrain, based on SE. The results show that SE had a strong direct influence on PU and PEOU of the e-learning system. Likewise, it has an indirect impact on the behaviour of students at the University of Bahrain towards the adoption of the e-learning system. Abbad *et al.* (2009b) find that SE has a statistically significant effect on PEOU of e-learning, while it is insignificant towards PU of the e-learning system. The result of the study in the adoption of technology for academic purposes confirms that computer SE (internet familiarity and computer experience) has a statistically substantial effect on PEOU (Abbad *et al.*, 2009b).

In the case of e-books, SE also emerges as a significant factor (Waheed *et al.*, 2015). According to the results of a survey that conducted at a government university in Kuala

Lumpur, Malaysia, the SE factor (human-assisted and individual) has a significant effect on the adoption of e-book readers (Waheed *et al.*, 2015). Jin (2014) also finds that SE seems to play an important role in PU and PEOU.

Based on the literature results, SE represents a significant factor (Burkhardt & Brass, 1990; Hayashi *et al.*, 2004; Waheed *et al.*, 2015). Therefore, it has been examined to determine the influence on students' acceptance of e-books among MAS students at universities in Libya.

#### **4.3.2.2 Resistance to Change (RC)**

Zaltman (1977, p. 63) identifies Resistance to Change (RC) as, “*any conduct that serves to maintain the status quo in the face of pressure to alter the status quo*”. RC is also known as a natural emotion that must be dealt with and not avoided (Mento, Jones, & Dirndorfer, 2002). When something new is tried, it usually produces feelings of anxiety and discomfort (Bonwell&Eison, 1991; Woods, 1994); in particular, when the change has been externally imposed (e.g. by the university, and the individual feels that they have relatively little control over the event (Fisher, 1994; Woods, 1994). RC includes the rejection of the use of particular types of technology, when the usage requires changing user habits, including the use of technology in education (Eshetu, 2015). According to the literature that has been reviewed in subsection 2.2.8, many students avoid making changes in their reading habits. The majority of the students prefer to use printed books in developed countries, despite the availability of e-books. According to Stork (2001), RC is one of the most important obstacles facing the deployment of e-books.

By extrapolating the opinions of students done by Åkerlind and Trevitt (1999), some students have welcomed the change in educational methods, especially those who have expressed dissatisfaction with the educational experiences using the traditional education model. This result is supported by Jones and Kember (1994), where they confirm that students, who are not dissatisfied with conventional approaches to higher education, are less resistant to change than others. In contrast, Jones and Kember (1994) also find that there is strong support among students for traditional teaching methods. Therefore, a large

number of students have expressed their satisfaction with the traditional methods in higher education, so it is expected that those students are more RC. Thus, having an RC or a sense of inhibition results in negative impacts upon the use of ICT either directly or indirectly (Cenfetelli, 2004). Bhattacharjee and Hikmet (2007) also suggest that RC has negative effects on users' behaviours to IT and the results have come to confirm this hypothesis.

Change creates anxiety unless identified and managed properly; change can slow down the learning procedure and subsequent success of the innovation. In addition, the lack of knowledge and understanding of this factor of innovation can result in disappointment for both staff and students related to the potential of educational technology (Åkerlind & Trevitt, 1999). Encouraging students and make them aware of the advantages of technology that can positively affect the acceptance of change. Turner (2005) suggests that the change in plans should be in place to break the barrier of fear and encourage the users on the change. For example, The officials should encourage influential figures such as faculty members and administrators staff on the usage of e-books because the change must start from those who are the role models for students (Turner, 2005). They should also give them some incentives, such as providing free e-books and e-readers (Turner, 2005).

Based on the above discussion, the factor of RC is tested in this research to determine its influence on students' acceptance of e-books.

#### **4.3.2.3 Language (LG)**

Language (LG) is a major challenge for electronic education users in many non-English-speaking countries, where most e-books are used in English (Alkharang & Ghinea, 2013a; Rhema, 2013; Sim *et al.*, 2014). Clearly, the language issue poses a cultural challenge in electronic education, where it is prominent that a great number of e-books are written primarily in English (Al-Tarras, 2014). As mentioned in subsection 2.2.7, the language factor is the most important obstacle facing most e-book users in the Arab world.

Most of the students in non-English-speaking countries are facing the language problem. In Indonesia, Sim *et al.* (2014, p. 1) report that:

*“the e-book/ e-reader situation in Indonesia will be presented to address the language issue. One of the challenges of e-books overseas is gauging if there is enough native language content available to maximise this emerging technology. U.S. based e-book providers are not likely to provide translated works if it is not profitable. And content providers in South-east Asian countries are still assessing the e-reader customer base”.*

Despite limited English speakers in Indonesia, the publishers admit that most e-books are currently only available in English (Sim *et al.*, 2014). Many students find it hard to comprehend their course materials and be familiar with how to use the functions of the e-book if they are written in a foreign language (Hatcher & Yen, 2005). The effect of L factor on the use of the e-book is clearly seen in Singapore as well, where there are four official languages in Singapore which are English, Mandarin, Malay and Tamil. A presence of limited e-books in the Malay and Tamil languages poses an obstacle to e-book users who are non-English speakers in Singapore (Sim *et al.*, 2014).

The language barrier represents an important factor as mentioned by Ali and Magalhaes (2008) in their research in Arab countries. The Report of Arab Human Development (2002) recommends that the policymakers in the Arab countries take the positive steps to encourage entrepreneurs, professionals, scholars and students to translate or develop various documents in the Arabic language and post them on the Internet. In 2010, Kulesz conducted in-depth research on digital publishing in developing countries and wrote about the Arab world as follows:

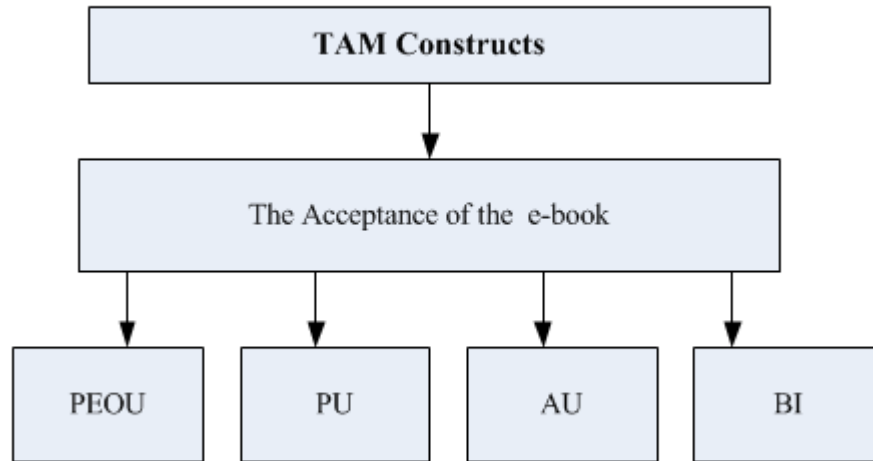
*“In the Arab world, digital publishing is highly incipient. The Arabic language represents a very powerful cohesive force, which may give rise to electronic platforms with transnational reach, but which at the same time – due to technical issues such as the treatment of fonts – involves numerous challenges. Of course, none of these challenges is insurmountable; in fact, the proliferation of blogs and the eagerness for digital content demonstrated by a section of the population indicates the potential that exists. If there*

*was a way to bring together its human resources and existing technology, the Arab world could become a significant player in the field of electronic publishing”.*

Snaije (2012) reports that the company of Ramy Habeeb of the Egyptian Kotobaria.com is the first company in the Arab world to adopt a project to convert printed books into e-books in Arabic. Unfortunately, no actual achievements have been made in the electronic publishing in Arabic so far. According to the study conducted recently in Kuwait by Ali and Magalhaes (2008); Alkharang and Ghinea (2013a), which aimed to find out the factors that influence the use of e-learning in Kuwait, language is one of the main obstacles that adversely affect the acceptance of the use of e-learning. Also, the study conducted by (Mirza & Al-Abdulkareem, 2011) confirms the importance of the language factor upon the acceptance and adoption of e-learning in the Middle East, where most subjects are written in English. Hashim (2008) also stresses the importance of the LG factor and recommends studying it as an influence on the use of technology in Malaysia. Due to the importance of this factor, the researcher felt that it was necessary to test its effect on the acceptance of e-books among MAS students at universities in Libya.

#### **4.3.3 Technology Acceptance Model Constructs**

Technology Acceptance Mode has been used in present research to explain students' behavioural intention of using the e-book. Figures 4.4 shows the constructs of the TAM model.



**Figure 4.4: TAM Constructs Group**

#### **4.3.3.1 Perceived Usefulness (PU) and Perceived Ease of Use (PEOU)**

Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) are two important constructs of the TAM model (Davis, 1989; Venkatesh & Davis, 2000; Venkatesh & Bala, 2008). In the e-book context, PU is described as the level of the individual's belief that the use of the e-book is useful to improve his/ her performance (Davis *et al.*, 1989; Davis & Venkatesh, 2004; Ngafeeson, 2011), such as the ability to install and have access to e-books, navigate and read online, etc. (Johnston *et al.*, 2015). PEOU is defined as the level of individual belief that the use of e-book is free of effort (Davis, 1989; Hashim, 2011; Ngafeeson, 2011), such as the rate of the usefulness of the various functions of e-books, including highlighting, taking notes, the search function, embedded links, etc (Johnston *et al.*, 2015).

The TAM is drafted to explain users' behaviour based on three factors which are PU, PEOU and AU (Mustafa *et al.*, 2014). PU is assumed to have a direct impact on BI or an indirect impact via the users' AU; whereas PEOU also has a direct impact on BI and an indirect impact through PU and AU (Davis, 1989). PU, PEOU, AU and BI are the TAM constructs (Figure 4.4).

Several research have confirmed that the PU and PEOU factors have a significant direct influence upon the BI to use technology or an indirect impact via users' AU (Davis, 1989; Martínez-Torres *et al.*, 2008; Letchumanan & Tarmizi, 2011a; Teo, 2011; Lee, 2013; Letchumanan & Muniandy, 2013; Elkaseh, Wong, & Fung, 2014). According to Letchumanan and Tarmizi (2011a), both factors of PU and PEOU have a significant impact towards BI to use the e-book. Armstrong, Lonsdale, and Nicholas (2006) report that e-books are perceived as extremely useful references for both learning and teaching activities. The results obtained by Letchumanan and Muniandy (2013) emphasise that PEOU and PU are important factors for non-users, where they contribute to the formation of positive attitudes towards the use of e-books. Also, PU has a larger impact on the AU of the adoption of e-books from PEOU. The importance of the relationship between PU and PEOU explains that PEOU is a significant factor in having e-books perceived as useful (Letchumanan & Muniandy, 2013). Ngafeeson and Sun (2015) conclude that PEOU and PU are important in determining the BI to use e-textbooks. These results are not surprising because many of the research in the TAM may get the same results (Davis, 1989; Venkatesh & Davis, 2000). The findings of the acceptance of the e-book in a mobile environment in South Korea is identical to the results of the study conducted by Lee (2013). Again, both PU and PEOU are statistically significant towards users' intention of the e-book in a mobile environment. PEOU has a positive impact on PU. The TAM constructs appear to have the ability to explain e-book adoption in the mobile environment.

Based on the research conducted by Bansal (2011), PU and PEOU have significant influences on users' AU, and BI. The PU of the participants has a strong effect on the motive to continue using e-books in contrast to their PEOU. The PEOU also affects the PU of the e-book for the students in a positive way. These determinants also serve as indicators of BI concerning the constant usage of e-books. Sieche et al. (2013) also studied the factors affecting the acceptance of e-books in Germany. The results of this study detect that PEOU and PU have a strong effect on students' AU to use the e-book. Users believe that the e-book would assist them to achieve a desirable result and improve

their performance. In addition, the independent factors, as suggested by Read, McQuilken, & Robertson (2010) were examined, but the relationship between the emotional attachment to paper books and students' AU towards e-books is negative. Generally, PU and PEOU are used to explain the relationship between different independent and dependent variables. Many studies have asserted the importance of both PU and PEOU, where they have a significant direct influence upon BI to use the e-book or an indirect impact via users' AU (Bansal, 2011; Letchumanan & Tarmizi, 2011b; Letchumanan & Muniandy, 2013; Ngafeeson & Sun, 2015a). It also contributes to explaining the causal relationships between independent and dependent variables (Bansal, 2011; Letchumanan & Tarmizi, 2011b; Letchumanan & Muniandy, 2013; Ngafeeson & Sun, 2015a).

#### ***4.3.3.2 Attitude Towards Using E-books (AU)***

The TAM describes AU as an individual's negative or positive emotions regarding performing the target behaviour (Venkatesh et al., 2003). AU is used to predict the individual's behaviour through filtering information and formatting the users' perception. Fourteen studies have investigated the users' AU towards the use of technology, twelve of them confirmed that PEOU and PU have a significant impact on the users' AU towards the use of technology (Letchumanan & Muniandy, 2013). Kim, Chun, and Song (2009) have investigated the role that AU plays in explaining the influence of users' AU on individual BI to use technology. Regardless of the power of the AU towards the use of the technology, the factor of AU is one of the most important factors that influence users' BI to adopt a particular technology.

In the case of the e-book, Ajzen (1991); Ngafeeson and Sun (2015b) confirms that the intention to implement a particular behaviour can be predicted by determining the attitude towards a specific behaviour on a particular issue. Based on the results obtained by Letchumanan and Muniandy (2013), AU towards using the e-book represents the significant predictor of BI towards the adoption of the e-book. Several studies of the acceptance of e-books point to the importance of AU to predict user's BI (Stoel & Hye Lee, 2003; Chang *et al.*, 2012; Letchumanan & Muniandy, 2013). Thus, most of the



results obtained conclude that the user's intention towards the adoption of e-books depends on his/ her attitude towards utilising e-books (Letchumanan & Muniandy, 2013). For example, if the non-users of e-books have positive AU towards the adoption of e-books, their intention therefore to use e-books will also increase according to their positions (Letchumanan & Muniandy, 2013).

#### **4.3.4 Gender Differences**

Many studies in the field of technology focuses on gender differences and their influence on technology acceptance (Shepperd *et al.*, 2008; Kang *et al.*, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; Letchumanan & Tarmizi, 2011a; Ngafeeson, 2011; Roesnita & Zainab, 2013; Marston *et al.*, 2014). The results of most of these studies have confirmed that gender plays an important role in defining the adoption and use of technology (Maduku, 2015c). According to Adam, Howcroft, and Richardson (2004), if the objective of the study is to develop the use of IT, we must take into consideration the effect of gender. This is because it seems that there is a significant difference between males and females in the decision-making process (Leong *et al.*, 2013; Zhou, Jin, & Fang, 2014; Maduku, 2015b). Therefore, gender has become a source of concern for many researchers in the acceptance of technology (Teo & Lee, 2010). There is numerous research that frequently argues that the gender subject in ICT applications is still under-theorised (Adam *et al.*, 2004). Other studies argue that there is no considerable association between the total use or non-use of ICT applications and gender (Igbaria & Baroudi, 1995; Gefen & Straub, 1997; Venkatesh & Morris, 2000; Ong & Lai, 2006).

In the acceptance of the e-book field, the majority of studies that have been conducted about the effect on gender differences in e-book use have been in developed countries, i.e. USA, UK and Canada (Shepperd *et al.*, 2008; Kang *et al.*, 2009; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; Letchumanan & Tarmizi, 2011a; Ngafeeson, 2011; Roesnita & Zainab, 2013; Marston *et al.*, 2014). Nevertheless, few studies have focused on researching the effects of gender difference on the acceptance of the e-book in the higher education sector in developing countries, i.e. South Africa, Trakya and Libya (Tosun, 2014; Maduku, 2015b). Most of these studies confirmed that the decisions made

by the students regarding the use of e-books are usually influenced by numerous factors incorporating the gender factor (Shepperd *et al.*, 2008; Letchumanan & Tarmizi, 2010; Woody *et al.*, 2010; Roesnita & Zainab, 2013). Tosun (2014) examines the rate of use of e-books amongst students at Trakya University Faculty of Education in Turkey. According to the results obtained, 34.1% of males chose the use of e-books, while only 14.8% of females selected e-books.

Maduku (2015c, 2015b) investigates gender differences in the antecedents of BI upon e-book usage as a learning medium among undergraduates and postgraduates at South Africa University, based on theoretical considerations rooted in the Theory of Acceptance and Use of Technology (UTAUT). This study examines the moderating influence of gender on the relationship between the facilities conditions, performance expectancy, SI, effort expectancy and students' BI towards using the e-book. Although there is a significant gender difference moderator on the relationship between facilitating conditions and behavioural intention, there is insufficient evidence on the significance of gender differences in performance expectancy, SI and effort expectancy.

Marston *et al.* (2014) studied the impacts of gender difference on the level of satisfaction and student adoption of the e-textbook. These results confirm the existence of a difference between the genders in the possibility of the student's choice of e-textbooks than printed books in the future. Although the results reveal that females are less frequently used to e-book than males, the use of the interactive features of the e-book is more common among females. However, there is no sufficient evidence of the existence of gender differences with respect to satisfaction, ease of use and usefulness.

Using gender as a moderator, Ngafeeson (2011) researched on the acceptance of e-books by undergraduate students. Gender difference has been measured through the investigation of the impact of moderating gender on the acceptance of e-books. Although there is a general significance of gender difference, there is insufficient evidence on the significance of gender differences in mutual relations between the TAM constructs. Moreover, Letchumanan and Tarmizi (2011a) suggest that gender does not have a significant impact on the use of the e-book. (Woody *et al.*, 2010) have also supported the statement of

Letchumanan and Tarmizi (2011a) and confirmed that there is no gender impact on the selection of e-books. The results obtained by Hage (2006) is also identical to previous studies. He has tested the impact of gender difference on the acceptance of the e-book. The outcome confirms that there is no difference between genders in the usage level of the adoption of e-books.

On the contrary, some researchers have found that the males' perception is significantly higher as compared to the females' perception towards using the e-book (Shepperd *et al.*, 2008; Roesnita & Zainab, 2013). These results are also supported by Marston *et al.* (2014). The results obtained by Marston *et al.* (2014) have emphasised that there is a significant difference between the genders, where males appear to be more used to the e-book than females. However, Kang *et al.* (2009) demonstrate that gender has a significant impact on the speed of reading. Although males spent about 7.4% more time than females in reading the e-book, the accuracy of male's reading was 4% less. Studies that are discussed have given mixed results. Therefore, the results indicate that despite the fact that gender differences have been theorised and tested with different levels of the empirical studies, the researchers must be aware of the generalisations when studying the gender effect on the use of technology. Based on previous literature, gender difference is used as the moderator to identify its effect on the acceptance of e-books among MAS students at universities in Libya.

#### **4.4 The Research Design**

The approach of quantitative research is utilised to investigate the factors that could have an effect on the acceptance of e-books among MAS students at universities in Libya. A quantitative research can be defined as, "*attempts to gather data by objective methods to provide information about relations, comparison and predictions without 'contamination' by the investigator*" (Armour & Macdonald, 2012, p. 80). Al-Aulamie (2013) points out that the approach of quantitative research is extensively used in many fields of Social Science research. Quantitative research is divided into two popular types: experiments and questionnaires (Al-Aulamie, 2013). Experiments allow researchers to control the test

environment, so they will be able to bind reasons and results. According to Gay, Mills, and Airasian (2011, p. 590), a questionnaire is “*a written collection of self-report questions to be answered by a selected group of research participants*”. The questionnaire is the most common in non-experimental design, and it is one of the most suitable methods used to test the theory. The questionnaire allows for communication with a broad cross-section of the study population; for example, the sample size for this research is relatively large (i.e., 392 participants). The questionnaire also provides the possibility of collecting data from unidentified participants, which denies the possibility of bias and increases the credibility of the research (Armour and Macdonald, 2012). There are many types of questionnaires; for example, online, oral and written questionnaires.

This research is fundamentally based on a quantitative questionnaire process that recognises the significance of locating the project within a particular cultural, social and historical context (Creswell, 2013). A copy of the research questionnaire is included in Appendix C1.

## **4.5 Settings of the Research**

### **4.5.1 Research Field Study Approval**

The participants were recruited from three public universities in Libya. In gaining access to these selected universities, two letters of support from the researcher’s research supervisors were sent to the President of each university. The first letter includes an invitation to the three universities to participate in the survey. Based on the decision of these universities, the researcher started announcing in these universities to attract students to participate in the survey. The second letter explains the objectives, benefits and potential risks of the research. The two letters are included in Appendices A and B. Appendices H, I and J include the letters from the Deans of selected universities to confirm their agreement to conduct this research on their campus. They also reaffirm their full support for the researcher to ensure the success of this investigation.

#### **4.5.2 Designing the Simplified Model for an E-book and a Guide to Explain How to Use It**

In Chapter Two, it has been mentioned that Libya, as a developing country, is still struggling to embrace technology in higher education. Due to these facts, it is anticipated that there will be a lack of knowledge of some of the participants and how they are able to use the e-book. Therefore, in this research, some information from an existing textbook was extracted and turned into a small e-book. An e-mail was sent to the original author of the textbook, Dr. Ali Husein, for approval to convert a portion of the fifth chapter of his book entitled “Statistics and Probability, Theory and Practice” into a PDF e-book. This PDF e-book was also converted into both Arabic and English (see Appendices D and E). To help participants understand and use the small e-book, the researcher also prepared another document containing a simple explanation with some images for the tools provided by the PDF (Appendix F).

#### **4.5.3 Translation of the Documents**

Since the first language of the participants is Arabic, most of the participants do not speak English well. Therefore, in this research, it was necessary to translate some documents. The researcher of this research has translated the questionnaire and all of the documents used in the survey into the Arabic language so as to assist the participants who may have a limited command of the English language. The translated copies have been validated by a language expert who is fluent in Arabic (Appendix C<sub>2</sub>).

#### **4.5.4 The Human Research Ethics**

Permission to collect data was sought from Murdoch University Human Research Ethics Committee in Australia. All research documents are enclosed with the project application (Appendices A, B, C<sub>1</sub>, C<sub>2</sub>, D, E, F, G, H, I and J). These documents have been subjected to review by the committee on Human Research Ethics, where the consent was given to begin the process of data collection. The approval number is 2014/028 (Appendix K).

## 4.6 Design of the Questionnaire

As part of the data collection process, the design of the questionnaire is critical because it can have an influence on the response percentages of the survey, the internal validity and reliability of the data (Hair *et al.*, 2007; Al-Aulamie, 2013). Gay, Mills, and Airasian (2006) point out that content validity is the degree to which the variables correctly represent the theoretical content of the construct. In relation to this research, most of the questions have been referred from previous studies, and they have been modified as needed for this research (Shelburne, 2009; Bierman, Ortega, & Rupp-Serrano, 2010; Foasberg, 2011; Muir & Hawes, 2013; Rhema, 2013).

Moreover, some questions were designed by the researcher of this research to suit the environment and nature of this investigation. Foddy (1994, p. 17) emphasises that “*the questions must be understood by the respondent in the way intended by the researcher and the answer given by the respondent must be understood by the researcher in the way intended by the respondent*”.

Therefore, there are several stages undertaken to develop the questionnaire while ensuring its validity and credibility. These stages could be summarised in the following points:

1. Determine the variables in order to measure factors. The first step involves identifying at least two variables of each factor (Hair *et al.*, 2010). As such, the researcher has identified many of the variables to measure each factor.
2. The second step is to determine the appropriate types of questions. Most studies in the acceptance of technology use the Likert-scale (Saunders, Lewis, & Thornhill, 2009). Saunders *et al.* (2009, p. 378) report that “*the respondent is asked how strongly he or she agrees or disagrees with a statement or series of statements, usually on a four, five, six or seven-point rating scale*”. A five-point Likert-scale is used in this research, ranging from 1 to 5 (1 = strongly disagree, 2= disagree, 3= neutral, 4= agree and 5 = strongly agree).
3. The pilot test has been used to develop the questionnaire and confirm the validity and credibility of the questions. It involves two steps. First, the questionnaire was

reviewed by two PhD supervisors. Based on their experiences and knowledge, the questionnaire was then modified. Second, the questionnaire was tested in a small pilot test to simulate the exact data collection procedures; as well as to ensure that the questions measure what they are intended to measure with a high degree of reliability (Algahtani, 2011). The pilot test was conducted using both postgraduate and undergraduate students from Libya. 29 of the respondents participated in the study of the pilot test. Algahtani (2011) recommends a sample size of at least 20 participants for a pilot study. In this research, the results obtained from the pilot study were accepted for most measurement variables via the Cronbach's alpha test. All participants stressed the ease of understanding the questionnaire without the need for assistance. Furthermore, the researcher did not receive any comments from the participants in the survey.

In the present research, the questionnaire is divided into six sections:

- Section A deals with the demographics of the participants, which include the universities of participants and their knowledge of the e-book.
- Section B offers some information about the current users' experience in utilising e-books. This section presents e-book familiarity, time for usage (i.e. daily, weekly, monthly), the goal of using the e-book, devices used, etc.
- Section C represents the extent of users' or potential users' belief that the e-book is easy to use, and it can help to enhance their knowledge and learning performance. It includes the factors of the TAM model.
- Section D is dedicated to understanding the issues that have a direct relationship with the individual behaviour of the user and the ability to use technology. It involves the factors related to the users or potential users.
- Section E represents the facilities available and the services provided to users of the e-book. It includes the factors relating to the infrastructure of educational institutions.

- Section F represents the factors related to the e-book itself. These factors may represent the advantages from the standpoint of some users or defects from another point of view, such as the cost of the e-book.

#### **4.6.1 Pilot Test**

The survey is a pilot test of the research methodology on a small scale, where it allows the researcher an opportunity to check the survey design and make the necessary adjustments before the actual study (van Teijlingen & Hundley, 2001; Rhema, 2013). There are a number of researchers who recommend doing a pilot test (van Teijlingen & Hundley, 2001; Collins, Hammond, & Wellington, 2002; Rhema, 2013; Wellington, 2015). Bell (2014, p. 147) recommends that *“all data-gathering should be piloted to check that all questions and instructions are clear and to enable you to remove any items which don't yield usable data”*.

In this research, the main purpose of doing a pilot test is to ensure that the participants in this research understand the questions in the questionnaire. Moreover, it also helps to confirm the clarity of the variables and the validity of the response categories.

##### **4.6.1.1 The Sample of the Pilot Study**

Although 33 of respondents participated in the pilot study, only 29 respondents completed the survey. The respondents consist of undergraduate and postgraduate MAS students at Al-Jabal Al-Gharbi University. The survey was emailed to the respondents. The pilot study data collection was conducted in March 2014.

##### **4.6.1.2 Result of The Pilot Study**

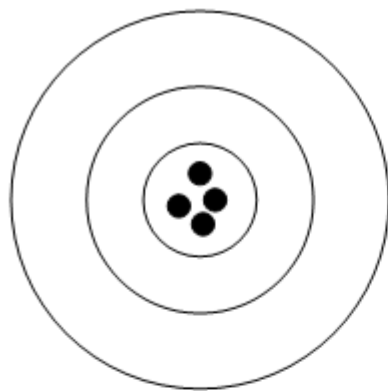
Validity and reliability are the most important metrics that are used to assess the quality of a survey instrument (Merriam, 1998). Rhema (2013, p. 80) confirms that:

*“measurement validity refers to the extent to which an instrument measures what it is intended to measure. Validity places emphasis on the objective of an instrument and the ability of the researcher to make inferences from the collected measurements”*.

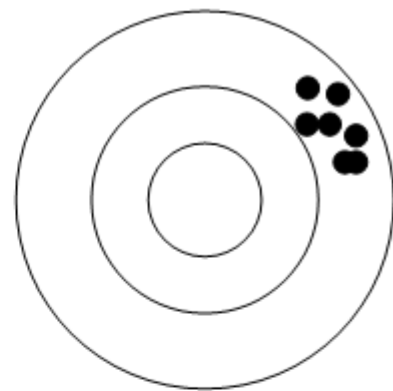


According to (Knapp & Mueller, 2010), there are many forms of validity; however content validity represents the most important type of all. Content validity is the suitability of the survey questions to get the required information (Rhema, 2013). It assumes that the questionnaire questions are devoid of elements that do not achieve the purpose of the study. Content validity is often determined based on expert judgment (Mertens, 1999). Therefore, two experts from the School of Engineering and Information Technology at Murdoch University, have reviewed the survey variables and made judgments about the validity of the content to achieve the objectives of this research. The comments made by the experts were considered before the questionnaire was used in the pilot study.

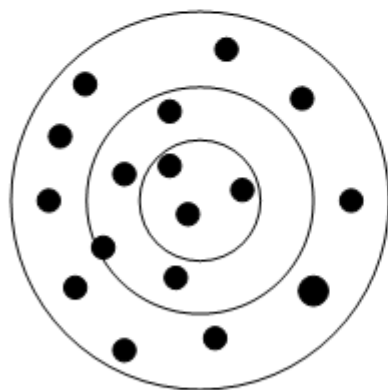
Reliability of a variable can be defined as the consistency of measurement, or its stability of measurement over a variety of conditions (Stafford, Stafford, & Schkade, 2004; Hair *et al.*, 2006). As mentioned in Figure 4.6, reliability is directly related to the measure of validity (Rhema, 2013, P.81). The availability of validity and reliability are not necessarily always together. Although the most useful instrument which has both validity and reliability are very important, validity is considered to be more important than reliability (Rhema, 2013). Cronbach's Alpha ( $\alpha$ ) is a statistical indicator used to measure reliability for internal consistency. The recommended value of Cronbach's Alpha is 0.7 and preferably closer to 0.9 (Stafford *et al.*, 2004; Hair *et al.*, 2006).



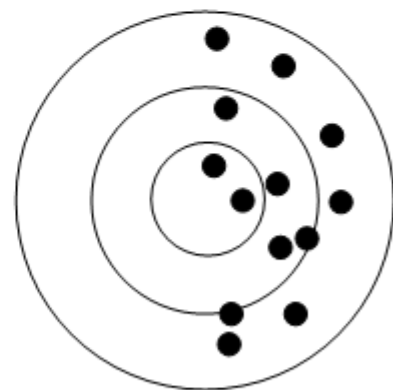
1) Reliable and Valid



2) Reliable and Invalid



3) Unreliable and Valid



4) Both Unreliable and Invalid

**Figure 4.5: The relationship between reliability and validity**

In this research, using IBM SPSS (V. 21), Cronbach's Alpha is used to measure the questions in the pilot study. Tables 4.1 presents the result of the Cronbach's Alpha for the pilot test with 59 variables while Table 4.2 illustrates the results of the reliability of each

factor in the Pilot Survey The results of the reliability obtained are in the range of the recommended value (0.70 or more).

**Table 4.1: Cronbach's Alpha for Pilot Test with 59 Variables**

<b>Number of survey variables</b>	<b>Cronbach's Alpha (<math>\alpha</math>)</b>
59	0.82

**Table 4.2: The Results of the Reliability of the Pilot Survey**

<b>Factors</b>	<b>Number of survey variables</b>	<b>Cronbach's Alpha (<math>\alpha</math>)</b>
Perceived Usefulness (PU)	5	0.79
Perceived Ease Of Use (PEOU)	4	0.75
Attitude towards (AU)	5	0.81
Behavioural Intention (BI)	4	0.82
Social Influence (SI)	4	0.76
Resistance to Change (RC)	8	0.75
Self-Efficacy (SE)	4	0.87
Language (LG)	5	0.77
Technical Services (TS)	4	0.72
Library Services (LS)	3	0.85
Accessibility (AC)	3	0.86
Cost (C)	3	0.93
Mobility (M)	3	0.87
Facilities (F)	3	0.77

#### 4.7 The Sample Population

Sekaran (2003) defines sample population as the selection process of the correct elements such as individuals, events or objects for the study. Sampling is one of the necessary stages of the scientific research process, which includes the collection of data from the original population of the study. The difficulty of conducting the comprehensive survey of all members of the population, especially in large communities, is due to the high costs incurred, as well as the fact that it requires considerable effort and time. Therefore, most researchers prefer to use the statistical sampling method (Hernon *et al.*, 2007). There are two types of sampling that are always used to study the population of research; random sampling (probability sampling) and non-random sampling (non-probability sampling). Random sampling provides an equal and independent chance for all members of the study population to be a part of the research sample, without bias or direct intervention from the researcher (Sekaran, 2003). It includes a random selection that means it depends on the theory of probability in the choice of elements. Random sampling has been used when the study population is defined and known in terms of geographical and numerical limits (Hernon *et al.*, 2007). There are several types of random sampling such as simple random sampling, stratified random sampling, regular random sampling, cluster sampling and double sampling (Lohr, 2009). However, non-random sampling does not include a random selection that means it cannot rely on the theory of probability in the choice of elements (Kumar, 1999). Non-random sampling is often used when the number of members of the population is either anonymous or cannot be determined individually (Kumar, 1999). In such cases, the selection of the sample members is based on other considerations such as researcher's experience. Non-random samples are divided into five types: quota sampling, accidental sampling, judgmental sampling, expert sampling and snowball sampling; each depends on a different consideration (Kumar, 1999; Costello *et al.*, 2000).

This research has used random sampling to identify the research participants because of the big research population, the lack of financial support and time required to conduct a comprehensive survey of all members of the population. The population of this research is the MAS students at universities in Libya. Therefore, the random sample was taken

from the research population for the purpose of this study. The survey covered the sample members only (Appendix C).

For the first part, which is the self-administered survey, the sample size required is calculated based on Yamane (1967) sample size and the table of the margin of error. The number of Mathematical and Statistics students at universities in Libya is approximately 20,000 students (General Peoples' Committee for Higher Education, 2008). According to the Yamane's sample size table, if the population is about 20,000, and to achieve a confidence level of 95%, the sample size should be 392 students. Moreover, the same result can be calculated by using Yamane's formula (Israel, 1992).

$$n = \frac{N}{1 + Ne^2}$$

where:

n= the sample size;

N= the size of population;

e<sup>2</sup> = the acceptable sampling error.

In this research, the participants were recruited from three public universities:

- Tripoli University (TU): It is located in the Libyan capital (Tripoli) and is one of the oldest universities in Libya with a student population of 115,000. It was established in 1957 (Rhema, 2013).
- Al-Zawia University (ZU): This is a local university situated outside of the Libyan capital. It is around 48 kilometres westwards of Tripoli. Al-Zawia University was founded in 1983, and the number of undergraduate students is about 47,322 (sourced from the respective university websites) (Rhema, 2013).
- Al-Jabal Al-Gharbi University (GU): It is a regional university situated on the exterior of the capital city Tripoli. It is almost 100 km to the south-west of Tripoli with a student population of 20,000. It was established in 1985 (Rhema, 2013).

These universities were selected because:

1. Tripoli, Al-Jabal Al-Gharbi and Al- Zawia Universities are all accredited universities by the Ministry of Higher Education in Libya. They are also government-funded universities.
2. The three universities reflect the geographical diversity in Libya, where Tripoli University is located in the heart of the capital Tripoli in the far north, where it represents an urban society. However, Al-Jabal Al-Gharbi University is located in the far-west of Tripoli and represents the rural community. Furthermore, Al-Zawia University is located in the north-west of Tripoli and accounts for a homogeneous mixture of the two former universities.
3. These three universities are the largest and oldest universities in Libya which attract students from all over Libya.

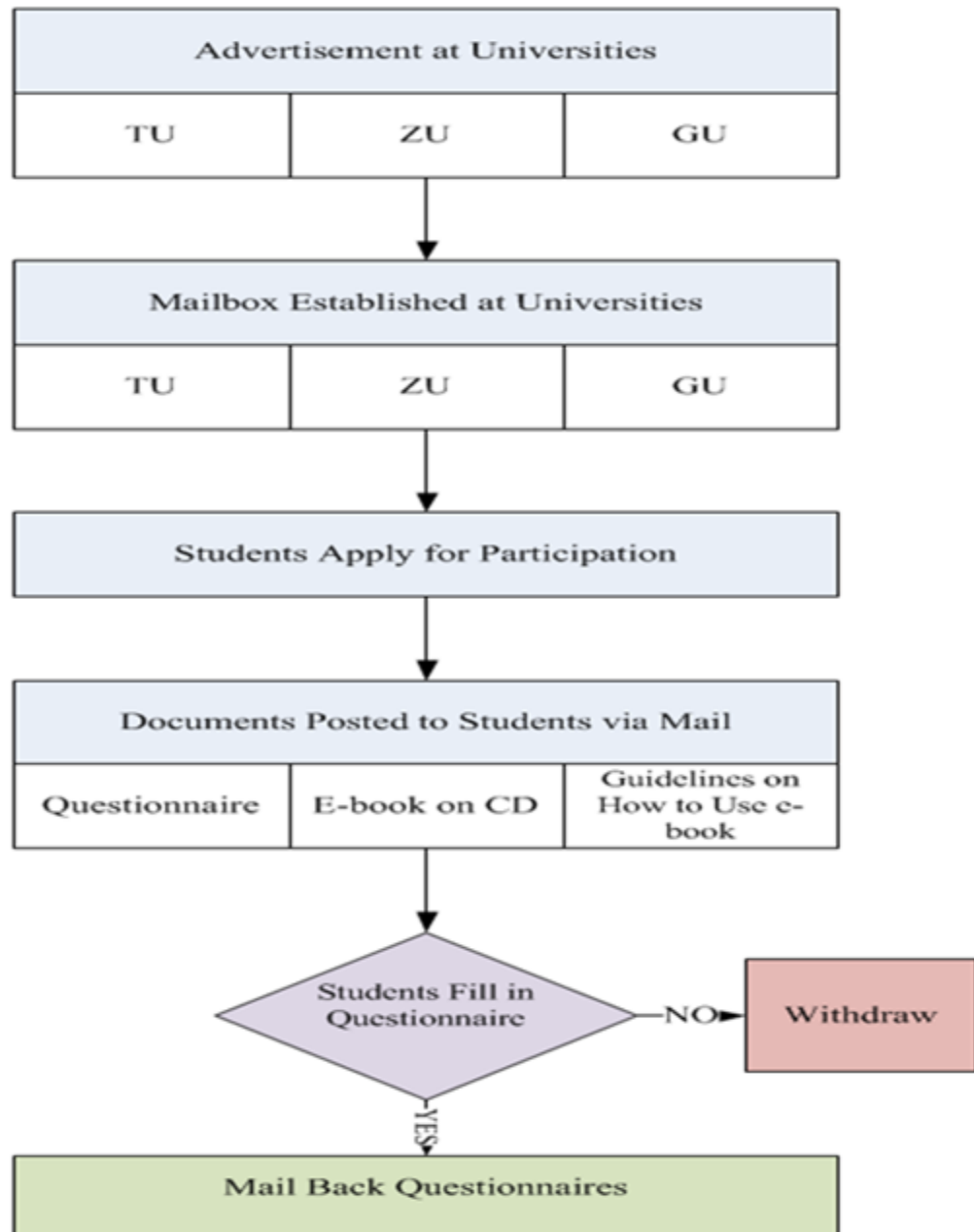
As mentioned in the definition of a random sample, the researcher should not interfere in the selection of the elements of the sample. Therefore, the percentage of the participants from each university is not important, as long as the sample size required is achieved (Mathers, Fox, & Hunn, 1998). Table 4.3 shows the number of participants in each of the selected universities.

**Table 4.3: The Number of Participants (Male and Female) in Each University**

University	Gender		Percentage
	Male	Female	
Al- Zawia University (ZU)	97	84	45.6
Tripoli University (TU)	69	73	36.2
Al-Jabal Al-Gharbi University (GU)	33	35	18.2
Total	199	192	100

## 4.8 Data Collection Process

Data collection, which includes several processes, is one of the most important stages of this research. Figure 4.6 illustrates these processes of data collection.



**Figure 4.6: The Processes of Data Collection**

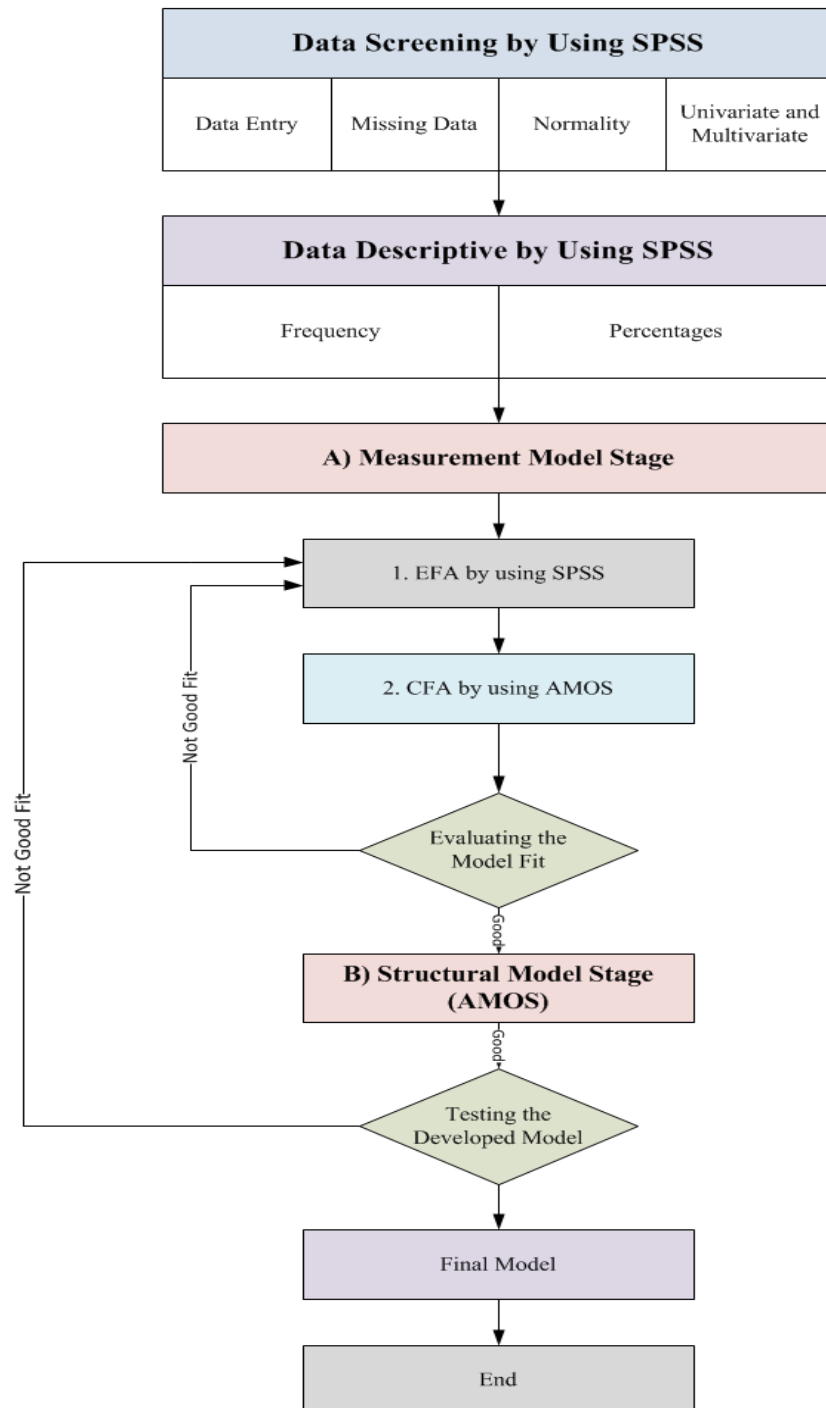
The first process in the data collection stage is to advertise at the selected universities using colour printed flyers (Appendix G). Each flyer has information such as the research topic and the researcher contact information, where students who are interested in participating can contact the researcher via phone or email. Then, the research survey package (questionnaire and all required documents) is sent to the participants via snail/normal mail. The research survey package includes the questionnaire, the e-book file on CD and guidelines on how to use the e-book. The researcher has committed to the secrecy in maintaining the participants' contact information (e.g. mail addresses, phone numbers and e-mail) that have been communicated to the researcher. At this point, the processes have arrived at the crucial stage, where the student decides to go ahead and fill in the questionnaire, or he/ she decides to withdraw. A student can still withdraw at any time even though he or she may have initially agreed to participate. Students who complete the questionnaire will then mail it back to the researcher.

In being more credible, the pilot test should be conducted in the community where the survey will be conducted. Since the researcher was not in the country of the study at that time, the pilot study was conducted by e-mail. On another hand, when the actual study was conducted, the researcher has travelled to Libya. Due to the low internet service in Libya in that period, the researcher chose the mail to send the questionnaire and accompanying documents to participants.

#### **4.9 The Technique of Data Analysis**

This section explains the technique used in the data analysis process in this research. Figure 4.7 shows the process of data screening and data analysis process.





**Figure 4.7: Data Analysis Process**

The Statistical Package for the Social Sciences (SPSS) (version 21) is used to screen data and analyse the data for descriptive statistics such as percentage mean, frequencies and standard deviation. Structural Equation Modelling (version 22) is used to determine the fit of the model and to test the research hypotheses as discussed in Chapter 5. The statistical analysis can be divided into four main stages: Data screening, Descriptive statistics, Measurement Model and Structural Equation Modelling (SEM).

#### **4.9.1 Data Screening**

Data screening is the first stage in the data analysis process. It is used to make sure that the collected data are clean, useful and valid for testing. In this stage, many issues such as missing data, outliers and normality have been tested.

##### **4.9.1.1 Missing Data**

Data that have been missed due to the lack of answers by the participants on some questions in the questionnaire is classified as missing data (Hair *et al.*, 2010). Hair *et al.* (2010) suggest dispensing any participants who do not answer 50% of the questionnaire questions.

##### **4.9.1.2 Normality**

According to Stamatis (2012, p. 393), normality is defined as, “*degree to which the distribution of the sample data corresponds to a normal distribution*”. Skewness and Kurtosis are statistical standards used to evaluate the normality of data. In addition, Kurtosis is a measure of whether the data are peaked or flat, compared with a normal distribution (Hair *et al.*, 2010). According to Hair *et al.* (2010), the large sample size helps to minimise the impact of non-normality. Kline (2015) suggests that the value of Skewness should be less than 3, while the level of Kurtosis is less than 10. SPSS (V21) was used to calculate the value of Kurtosis and Skewness for each of the variables used in this research. The Skewness and Kurtosis can be calculated from the following statistical formula:

$$\text{Skewness} = \frac{n}{(n-1)(n-2)} \sum_{i=1}^n \left( \frac{x_i - \bar{x}}{s} \right)^3$$

where:

$\bar{x}$  = The average of sample size;

$n$  = The size of sample;

$x$  = Observation values;

$s$  = The standard deviation of sample.

$$\text{Kurtosis} = \frac{n}{(n-2)(n-3)} [(n+1)g_2 + 6]$$

$n$  = The size of sample;

$$g_2 = \frac{m_4}{m_2^2};$$

$m_r$  = Sample moments.

#### 4.9.1.3 Univariate and Multivariate Outliers

An outlier can either be defined as an extremely small or large value in the data collection for each factor (a univariate outlier) or a combination of such values of two or more measured variables (a multivariate outlier) (Hair *et al.*, 2010). Therefore, the data were tested for two types of outliers (univariate and multivariate). First, the univariate outliers are calculated by computing the standardised value ( $z$ ) for the measured variables. There are two proposed cut-off values to test for univariate outliers. The first cut-off value is  $z \leq \pm 3.2$ , which is suggested by Tabachnick and Fidell (2007). The other cut off value is  $z \leq \pm 4$ , which is recommended by Hair *et al.* (2010). The second is the multivariate outliers, which is usually used to determine the extreme values of more than two variables at the same time (Cramer & Howitt, 2004). Multivariate outliers are computed by the Mahalanobis Distance ( $D^2$ ) (Farber & Kadmon, 2003). A measured variable can be defined as a multivariate outlier, if  $(D^2/df > 4)$ , where  $D^2$  represents the Mahalanobis Distance and  $(df)$  represents the degree of freedom (Al-Aulamie, 2013). Mahalanobis Distance can be calculated from the following statistical formula:

$$D^2 = (X - M)^T C^{-1} (X - M)$$

where:

$X$  = Data vector;

$M$  =Independent variables vector of mean;

$C^{-1}$  =Independent variables inverse covariance matrix;

$T$  = Transposed vector.

#### 4.9.2 Descriptive Statistics

Descriptive statistics is the second stage in the data analysis process, which is usually used to describe the main features of the data, such as the data distribution in the research (Nicholas, 1990). The distribution can be defined as a summary of the frequency of the values for a variable. In this research, individual values of the variable are the options that are given to participants in each question, while the frequency of the values for a variable represents the number of participants in each option (Bickel & Lehmann, 2012). Descriptive statistics provide basic summaries of the sample and measures (i.e. frequencies, graphic columns and percentage of participants). Along with simple graphics analysis, descriptive statistics constitute a practical basis for the analysis of quantitative data. Therefore, descriptive statistics have been used to describe the data gathered from students' demographic and experience. In this section, the Statistical Package for Social Sciences (SPSS V.21) is used to analyze the data.

#### 4.9.3 Measurement Model

The Measurement model is the first stage to check the goodness-of-fit of the developed model. This section addresses the measurement model for each latent variable in the developed model. Prior to the development of the measurement model, the variables of each factor will be tested through internal consistency assessment and unidimensionality. Unidimensionality is defined by Hair *et al.* (1995) as, “*an assumption underlying the calculation of reliability and is demonstrated when the indicators of a construct have an acceptable fit on a single-factor (one-dimensional) model*”.

Exploratory Factor Analysis (EFA) was conducted to test the dimensionality of the variables. EFA is usually used to provide the evidence of unidimensionality of the variables of each measurement factor using SPSS.

#### **4.9.3.1 Exploratory Factor Analysis (EFA)**

An Exploratory Factor Analysis (EFA) using maximum likelihood with Pormax rotation was used to test the unidimensionality of the factors in each measurement instrument (Lowry & Gaskin, 2014). EFA provides the evidence of unidimensionality of the variables of each factor. EFA also checks whether the factors sufficiently correlate and are up to the standard of validity and reliability. EFA provides a platform to explore how the factors relate and are grouped on the basis of intervariable correlation. EFA is usually used to provide evidence of unidimensionality of the variables of each factor and to check the validity of the factors proposed and compare the initial reliability of the variables by the test of internal consistency.

Reliability of the variable-level can be defined as its stability within a single factor (Stafford *et al.*, 2004; Hair *et al.*, 2010). Reliability will help to identify the reliable group of variables which will load within a factor without any variation. The reliability of variables takes into consideration the need to calculate the internal consistency, by using Cronbach's Alpha ( $\alpha$ ) for each factor. The recommended level of Cronbach's Alpha ( $\alpha$ ) is at least 0.7 (Hair *et al.*, 1995). It can be calculated as:

$$\text{Cronbach's Alpha } (\alpha) = \frac{N \cdot \bar{C}}{\bar{V} + (N-1) \cdot \bar{C}}$$

where:

N = the number of measurements for one variable;

$\bar{C}$  = Inter-variable covariance among measurements;

$\bar{V}$  = the average variance.

Adequacy is also conducted in this phase to confirm the appropriateness of the data. The Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity test is a measure of sampling

adequacy (Anastasiadou, 2011). The KMO ranges from 0 to 1, and the accepted value is over 60% (Lowry & Gaskin, 2014). Bartlett's Sphericity test enables us to test the hypothesis that the correlation matrix is an identity matrix. A significant result (sig. < 0.05) means that the loading matrix is not an identity matrix; i.e., the measured variables do relate to one another enough to run a meaningful EFA (Lowry & Gaskin, 2014).

Construct validity can be defined as the degree to which test scores can be interpreted as reflecting a particular psychological construct (O'donnell *et al.*, 1994). Both convergent and discriminant validity is used to test the construct validity (Mondi, Woods, & Rafi, 2008). Convergent validity of a variable implies that the variables around a single factor are greatly correlated (Mondi *et al.*, 2008). Hair *et al.* (2006); Kannan and Narayanan (2015) recommend that convergent validity is achieved when the loading recorded by the variables is above the proposed standard of 0.30 for a sample size of 350 or more. Discriminant validity measures how distinct or uncorrelated a variable is to another. In EFA, two methods are available for finding discriminate validity. One is to test the pattern matrix, while the other assesses the factor correlation matrix (Lowry & Gaskin, 2014). In the first method, the variables must load significantly only on one factor. In the second method, correlations between the factors must not exceed 0.7 (Lowry & Gaskin, 2014).

#### **4.9.4 Structural Equation Modelling (SEM)**

SEM is a “*multivariate technique combining aspects of factor analysis and multiple regressions that enables the researcher to simultaneously examine a series of interrelated dependence relationships among the measured variables and the latent constructs (variates) as well as between several constructs*” ((Hair *et al.*, 2006, p. 710) cited by Kats (2013, p. 102)). SEM is called the model of simultaneous equations, where the dependent variable in the structural equation may be the same independent variable in other structural equations. The variables of structural equations could affect each other mutually, either directly or indirectly through the mediator variables. The structural equations are designed to represent the causal relationships between the variables in the model. Latent variables are one of the most important concepts in structural equations models, where it cannot be directly observed (Bollen, 2014). Latent variables can only be measured

through some of the other observed behaviours (that can be directly observed and measured) such as intelligence, passion and anxiety (Bollen, 2014). Therefore, the structural equation model is used to predict the unknown parameters in the structural linear equations, where the variables in these equations are often latent variables or observed variables. According to (Kline, 2015), SEM deals with many types of models: (1) Regression Models; (2) Path Models; (3) Multilevel Models; (4) Multiple Group Models; (5) Factor Models; (6) Mixture Models; (7) Latent Growth Curve Models; (8) Interaction Models; (9) Multiple Causes – Models Indicators and 10) Dynamic Models.

In the technology adoption field, SEM has been widely used by many published studies for its ability to predict the full model, as well as the integration, for example in both measurements and structuring perceptions (Davis, 1989, 1993; Venkatesh & Morris, 2000; Venkatesh *et al.*, 2003; Selim, 2007; Abbad *et al.*, 2009b; Creswell, 2013).

The process of SEM is carried out through two approaches, namely Confirmatory Factor analysis (CFA) and structure model analysis. The AMOS 22 have been used in this stage of data analysis. Many researchers have recommended using these two approaches to building and developing models (Anderson & Gerbing, 1988; Mulaik *et al.*, 1989). The measurement model represents the part of the theoretical model that measures the relationship between the latent variables and their measures, while the structural model represents the relationship between the latent variables only (Bollen, 2014).

#### **4.9.4.1 Confirmatory Factor Analysis (CFA)**

Confirmatory Factor analysis (CFA) is a statistical method usually used for verifying a factor structure of a set of observed variables (Hair *et al.*, 2010). CFA is also defined as the measurement model because it is the process taken to determine how the factors are measured by the indicators (variables). It is the step to follow after EFA, and it helps in finding the factor structure of a dataset. Prior to conducting EFA, the CFA is defined as the measurement model because it is the process taken to determine how the factors are measured by the indicators (variables). The main objective of using the measurement model is to determine the reliability and validity of constructs. According to Hair *et al.*

(1995), unidimensionality can be defined as, “*an assumption underlying the calculation of reliability and is demonstrated when the indicators of a construct have an acceptable fit on a single-factor (one-dimensional) model*”. CFA has the ability to assess constraints on the variables of the factor model to the methodology of EFA (Marsh, Balla, & McDonald, 1988). EFA provides a platform to explore how the factors relate and group by intervariable correlation, but CFA helps in confirming the factor structure extracted in the EFA. CFA, therefore, clarifies how well the identified model gives rise to the observed covariance among the indicator variables. Confirmatory factor analysis, therefore, indicates how well assigned the measured variables are to measure the model variables. It further deals with the measurement side of the developed model which is referred to as the measurement model. In the measurement model, the structural relationship between the variables that have been suggested in the developed model in this research is swapped by correlation relationships, that is, covariance (Al-Aulamie, 2013). CFA is used to confirm the validity and reliability of the constructs by using goodness-of-fit and construct validity. In this research, six measures have been selected to assess the validity of the developed model.

#### **A. Goodness-of-Fit Measures (GOF)**

Goodness-of-Fit is defined by Hair *et al.* (2010) (cited by Al-Aulamie (2013, p. 58)) as, “*how well the specified model reproduces the observed covariance matrix among the indicator variables*”. Six measures have been chosen to evaluate the validity of the developed model, Chi-Square Test ( $\chi^2/df$ ), Goodness-of-fit index (GFI) and Adjusted Goodness-of-fit index (AGFI), Root mean square error of approximation (RMSEA), Standardized root mean residual (SRMR), Comparative fit index (CFI) and Tucker-Lewis index (TLI). The measures used in this research are famous and very widely used. Due to the large sample size, the researcher did not select the measures, such as Normed Chi-Square (NC), that are sensitive to large samples (Sharma *et al.*, 2005; Lomax & Schumacker, 2012; Al-Aulamie, 2013).



### 1 The Chi-Square Test ( $\chi^2/df$ )

The chi-square represents the oldest measure of fit. According to Hair *et al.* (2010), the good value should be  $<3.0$ . Chi-square/df (cmin/df)  $<3$  indicates an acceptable fit between the hypothetical model and sample data.

### 2 Goodness-of-fit Index (GFI) And Adjusted Goodness-of-Fit Index (AGFI)

The scope of this measure is among 0, and 1 and the accepted value is greater than 0.80 (Gim, 2014; Hair *et al.*, 2010), whereas Al-Aulamie (2013) recommends GFI of more than 0.90. There is a decrease in the Goodness-of-Fit Index used because it is sensitive to the sample size (Sharma *et al.*, 2005; Al-Aulamie, 2013). However, Jöreskog and Sörbom (1989) developed AGFI (Schermelleh-Engel, Moosbrugger, & Müller, 2003). The AGFI is usually used in the case of complex models, and the recommended value is more than 0.80 (Al-Aulamie, 2013).

$$\text{Goodness of Fit Index (GFI)} = \frac{\hat{F}}{\hat{F}_b}$$

where:

$\hat{F}$  = minimum value of the discrepancy function;

$$\hat{F}_b = \sum(g) = 0, \quad g = 1, 2, \dots, G.$$

### 3 Adjusted Goodness-of-Fit Index (AGFI)

$$\text{AGFI} = 1 - \frac{df_n}{df_t} (1 - \text{GFI}) = 1 - \frac{\chi^2_t/df_t}{\chi^2_n/df_n}$$

where:

$\chi^2_n$  is the chi-square of the null model;

$\chi^2_t$  is the chi-square of the target model;

$df_n = p(p + 1)/2$  is the number of degrees of freedom for the null model;

$df_t$  is the number of degrees of freedom for the target model.

#### 4 Root Mean Square Error of Approximation (RMSEA)

The RMSEA is the most recognised standard and is widely used in many studies. The best value of RMSEA recommended by Hair (2010) is less than 0.05, and it is still acceptable if the value is less than 0.08 (Hair *et al.*, 2010).

$$\text{RMSEA} = \sqrt{\frac{\hat{F}_0}{d}}$$

where:

d = degree of freedom;

$\hat{F}$  = Minimum value of the discrepancy function.

#### 5 Standardised Root Mean Ral (SRMR)

Kenny (2011) defines SRMR as “the standardised difference between the observed correlation and the predicted correlation”. A value below 0.08 is generally acceptable (Hu & Bentler, 1999; Kenny, 2011).

$$\text{SRMR} = \sqrt{\frac{2}{k(k+1+2\delta)} \left[ \sum_i^K \sum_j^i \frac{(c_{ij} - \hat{\sigma}_{ij})^2}{c_{ii}c_{jj}} + \delta \sum_i^k \frac{(\bar{x}_i - \hat{\mu}_i)^2}{c_{ii}} \right]}$$

where:

K = the number of identified variables;

C = matrix of correlation;

$\bar{x}_i$  = the sample means of the p-vector;

$\hat{\mu}_i$  = the mean vector predicted;

$\hat{\sigma}_{ij}$  = the correlation matrix predicted;

$\delta$  = the structures mean.

## 6 Comparative Fit Index (CFI)

This is the most common measure that is based on the non-centrality measure (Kenny, 2011). The best acceptable value is above 0.90. CFI is less affected by complex models (Al-Aulamie, 2013).

$$CFI = \frac{\max(\hat{c} - d, 0)}{\max(\hat{c}_b - d_{b,0})}$$

where:

$(\hat{c} - d, 0)$  = the non-centrality, degree of freedom and discrepancy parameters for the model being evaluated;

$(\hat{c}_b - d_{b,0})$  = the non-centrality, degree of freedom and discrepancy parameters for the Baseline model.

## 7 Tucker-Lewis Index (TLI)

The preferred measure of value is between 0 and 1, and the best model is when TLI is less than 0.90 (Janssens *et al.*, 2008; Hair *et al.*, 2010).

$$TLI = \frac{\frac{\hat{c}_b}{d_b}}{\frac{\hat{c}_b}{d_b}} - \frac{\frac{\hat{c}}{d}}{1}$$

where:

$\hat{c}_b$  = the discrepancy of the baseline model;

$d_b$  = the degree of freedom of the baseline model;

$\hat{c}$  = the discrepancy of the model being evaluated;

$d$  = the degree of freedom of the model.

## B. Validity and Reliability

In CFA, it is very important to find out the convergent and discriminant validity, and the same is true of reliability. Composite Reliability (CR), Average Variance Extracted (AVE) and Maximum Shared Variance (MSV) are among the important measures for

testing the constructs' validity and reliability (Cramer and Howitt, 2004). The CR and AVE can be calculated from the formulas below:

Composite reliability (CR) = (Square of the summation of factor loadings) / (square of the summation of factor loadings) + (summation of error variances).

Average variance extracted (AVE) = (Summation of the square of factor loadings) / (summation of the square of factor loadings) + (summation of error variances).

#### **4.9.4.2 Structural Model**

Structural model evaluation is the last stage to check the goodness-of-fit of the structural model in order to measure the importance of the hypothesised paths in the research model and to test the variance ( $R^2$ ) interpreted by the dependent variables. The measures of goodness-of-fit that are used to test the measurement model are used again to measure the structural model. The research hypotheses are examined using path analysis via regression weights for the parameters ( $\beta$ ), standardised path coefficients between models construct the significance of the estimated coefficients (Critical ratio) and probability value (p-value). According to Vogt & Johnson (2011), the probability value is, “the probability that a statistic would occur by sampling error if the null hypothesis is true”. Moreover, the standardised coefficient is defined as, “*a statistic that provides a way to compare the relative importance of different variables in a multiple regression analysis*” (Vogt & Johnson, 2011). The standardised coefficient indicates the estimation value for the dependent and independent variables.

### **4.10 Indirect and Total Effect**

The path model has two types of effects (Lea, 2006). The first is named direct effect, while the second is an indirect effect. The direct effect of variables is defined as any change in the results of the variable X that leads to a direct effect on the variable Y. The direct effect appears when the independent variable's shares are directed towards the dependent variable ( $X \rightarrow Y$ ). However, the indirect effect is defined as the influence of the independent variable on the dependent variable through the mediator variable (Lea,

2006). According to Hayes (2009), the amount of mediation is called the indirect effect. Indirect impact occurs when there is an intermediary factor, where variable X has an effect on variable Y through variable Z ( $X \rightarrow Z \rightarrow Y$ ). The indirect effect can be found by determining the effect of the endogenous variables by one or two mediating variables (Kannan & Narayanan, 2015). The total effects of the independent variable are the summation of the direct and indirect effects (Lea, 1997). Cohen (1992) classifies the total effects into three major levels:

- (1) Any total effect close to 0.5 or more is classified as a strong effect.
- (2) Any total effect less than 0.4 is of moderate strength.
- (3) The total effects that are less than 0.2 are of weak strength.

#### **4.11 Estimation**

This section discusses how path analysis is used to estimate the parameters of a structural model. Translating a path diagram into a series of structural equations is an uncomplicated procedure (Moutinho & Hutcheson, 2011). In addition to being representing a form of multiple regressions, which focuses on the causal relationship, path analysis also represents a special case of SEM (Wright, 1934). According to Ahn (2002), the PL method is not an alternative to regression analysis; but it is used as a supplement to the regression analysis method because both models belong to the family of general linear models. Path analysis is a direct extension of multiple regressions (Lea, 2006).

Structural equation modelling (SEM) is designed to test the complicated models in a single analysis, instead of testing separate regression analyses (Ahn, 2002). The goal of SEM is to provide estimates of the magnitude and significance of hypothesised causal connections between the set of variables (Lea, 2006). It is worth mentioning that PL supposes a unit variance for all the variables, allowing the comparison of the quantities of each variable to be included (Lea, 1997). Each dependent variable can be estimated by independent variables or by other dependent variables. For each hypothesised effect, a structure coefficient is estimated because the prediction error will appear just as in multiple regressions (Moutinho & Hutcheson, 2011). PL supposes that all variables can be measured

without error (Hair *et al.*, 2010). Standardised path coefficients are used to compare the magnitudes of each factor including both direct and indirect effects.

As mentioned in Chapter Three, SEM is a Multiple Regression technique where there could be multiple dependent variables (Byrne, 2013). According to Walker (2012), SEM is defined as a multivariate extension of the multiple regression models ( $y = a + bX + e$ ) with one dependent variable, where  $y$  is a vector containing observed scores on the dependent variable,  $a$  is a vector representing the  $y$ -intercept,  $b$  represents the vector of regression weights,  $X$  represents a matrix of continuously distributed or categorical (dummy coded) independent variables and  $e$  is the vector of residual or error or leftover scoring unexplained by the model. SEM consists of a series of multiple regression equations that are fitted together (Walker, 2012). Solving these equations requires the use of matrix algebra, which greatly increases the complexity of the calculation and analysis operations (Walker, 2012). However, there are some statistical programs such as AMOS that can implement the calculations.

#### **4.12 Moderating Effects of Gender**

This research has utilised multi-group analysis to explore the moderating impact of gender on the relationship between the constants in the developed model. Multi-group analysis has been used to investigate the influence of moderators. According to Gaskin (2016b), a multi-group moderation is “*a special form of moderation in which a dataset is split along values of a categorical variable, i.e. gender, and then a given model is tested with each set of data*”. In this research, the model was tested for males and females separately.

The measurement and structural model test were used to examine the measurement and structural models in this research. First, the measurement model was tested for the differences between the genders in term of the measured variables (dependent and independent variables). In addition, the structural model was also tested for the differences between the genders in term of the hypotheses. By using AMOS, multi-group analysis classified

data on the basis of the value of grouping (i.e. gender) and the group analyses were performed simultaneously among males and females (Byrne, 2013).

Chi-square differences and critical ratios are two ways to measure the differences between multi-group moderation such as genders. The researcher used the difference in the chi-square ( $\Delta\chi^2$ ) to test if there are significant differences among genders on the measurement model, as well as the structural model level. Hair *et al.* (2010) identified chi-square as a statistical measure of differences that is commonly utilised to compare and estimate the matrices of covariance. In the measurement model, the chi-square  $\chi^2$  is computed through CFA; whereas the structural model is calculated through SEM. Byrne (2013) suggests that the difference in chi-square  $\chi^2$  can be calculated by finding the chi-square  $\chi^2$  twice for the developed model. For the first time, it should be computed without any weight constraints and then with weight constraints. If the result of the difference in chi-square  $\Delta\chi^2$  is significant, that means the model is not equivalent over the genders.

#### **4.13 Summary**

This chapter explains the methods that have been employed in this research. The research framework is mentioned in the first subsection, where the theoretical model that was subjected to measurement in the present research is introduced. Therefore, this chapter has identified the external factors and TAM constructs through a critical study of previous literature. Moreover, the effect of gender difference on the acceptance of e-books is still controversial among many researchers. Therefore, the effect of gender difference is measured after a thorough study of the previous research. This chapter also addresses the methods used in research design and the design of the questionnaire. The Pilot test is one of the most important methods used to check the reliability and validity of the questionnaire questions. The stages of preparation of this research are discussed in the setting of the research. The setting of the research has required some processes such as research field study approval, designing the simplified model for an e-book and a guide explaining how to use it, as well as a translation of the documents and the decision of human research ethics. This chapter also includes the population and sample size calculation and clarifies

the process of data collection. The last section of this chapter is the technique of data analysis. This section involves data screening, descriptive statistics, measurement model, structural equation model, indirect and total effect, estimation and the moderating effect of gender.



## **5 Chapter Five: Data Analysis and Results**

### **5.0 Overview**

This chapter presents the results of the quantitative data analysis that was conducted, as reported in Chapter 4. It covers the data analysis, and it includes many sections. Section 5.1 addresses the data screening. This section includes data processing, which treats many problems such as missing data issues, normality and outliers. Section 5.2 includes the analysis of descriptive statistics. Descriptive statistics provide basic summaries of the sample and measures (e.g. frequencies, graphic columns and percentage of the participants). Descriptive statistics constitute a practical basis for the analysis of quantitative data. Therefore, descriptive statistics have been used to describe the data gathered from students' demographics and experience. In section 5.3, the model measuring process is carried out through the Exploratory Factor Analysis (EFA) using SPSS. EFA is a statistical technique used to detect the underlying structure of a relatively large group of variables without imposing prior structure on the results. Section 5.4 addresses the Confirmatory Factor Analysis (CFA) and structural model. CFA is used to measure the model reliability, goodness-of-fit and construct validity. The structural model is tested via goodness-of-fit, analysis, path coefficients, and variance. The hypotheses of the research have examined in section 5.5. Section 5.6 addresses the direct, indirect and total effects of the dependent and independent variables. Section 5.7 reviews the estimation of the dependent variables through a series of equations. Section 5.8 investigates the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books among MAS students at universities in Libya.

### **5.1 Data Screening**

Preliminary data may have suffered from some issues like linearity, missing data, normality and outliers. Therefore, the collected data is subjected to a number of tests to ensure their quality and validity (Lowry & Gaskin, 2014). In the data screening stage, the work will be for processing the data to make it ready for analysis in the next stage.

### 5.1.3 Missing Data

The missing data represents data that have been lost due to the lack of the answers by the participants on some questions found in the questionnaire (Hair *et al.*, 2010). Through the process of sorting, the gathered data show that there are three incomplete responses out of the 392 participants; two responses suffered from 1% of missing data, whereas the third one failed to answer 60% of the questions in the questionnaire. Hair *et al.* (2010) suggest dispensing any participants who do not answer 50% of the questions. Therefore, the two incomplete responses are replaced by statistics of the medium, while the third participant is cancelled.

### 5.1.4 Normality

Based on the results obtained in Table 5.1, the value of the measured variables are located in the acceptable range (Skewness  $< 3$ , Kurtosis  $< 10$ ), as recommended by Kline (2015).

**Table 5.1: Skewness and Kurtosis Results**

<b>Factors</b>	<b>Measured Variables</b>	<b>Skewness</b>	<b>Kurtosis</b>
PU	PU1	-1.086	1.863
	PU2	-1.266	2.566
	PU3	-0.625	0.089
	PU4	-1.174	1.474
	PU5	-1.157	2.616
PEOU	PEOU1	-0.910	1.065
	PEOU2	-0.854	0.769
	PEOU3	-0.676	0.388
	PEOU4	-0.658	0.134
BI	BI1	-1.391	2.190
	BI2	-0.448	-1.087
	BI3	-1.626	2.060
	BI4	-1.208	1.551
AU	AU1	-0.552	0.100

<b>Factors</b>	<b>Measured Variables</b>	<b>Skewness</b>	<b>Kurtosis</b>
	AU2	-1.193	2.114
	AU3	0.906	0.524
	AU4	-0.822	1.368
	AU5	-0.963	1.334
SI	SI1	-1.106	1.540
	SI2	-1.780	3.894
	SI3	-1.082	0.794
	SI4	-1.144	0.896
RC	RC1	0.627	-0.057
	RC2	0.687	-0.058
	RC3	-0.469	-1.116
	RC4	1.187	0.925
	RC5	0.917	0.125
	RC6	-0.443	-1.153
	RC7	-0.606	-0.893
	RC8	-0.374	-1.255
SE	SE1	-0.678	-0.173
	SE2	-0.793	0.429
	SE3	-0.569	-0.048
	SE4	-0.695	0.350
LG	LG1	0.686	-0.576
	LG2	0.709	-0.383
	LG3	-0.752	-0.824
	LG4	1.040	-0.376
	LG5	0.924	0.242
TS	TS1	0.210	-1.576
	TS2	0.130	-1.442
	TS3	0.084	-0.813
	TS4	-0.083	-1.396

Factors	Measured Variables	Skewness	Kurtosis
LS	LS1	1.119	0.076
	LS2	1.155	0.429
	LS3	0.963	0.063
AC	AC1	0.078	-1.346
	AC2	0.273	-1.301
	AC3	0.054	-1.373
C	C1	0.681	-0.232
	C2	0.543	-0.250
	C3	0.654	-0.901
M	M1	-1.165	1.405
	M2	-0.948	0.917
	M3	-0.620	-0.118
F	F1	-0.955	1.126
	F2	-0.820	0.953
	F3	-0.889	0.791
	F4	-0.898	0.246

#### 5.1.5 Univariate and Multivariate Outliers

The data were tested for two types of outliers (univariate and multivariate). There are 59 measured variables that have been used to measure the factors for the developed model, and each measured variable was examined for univariate outliers and a multivariate outlier. First, the univariate outliers are calculated by computing the standardised value ( $z$ ) for the measured variables. There are two proposed cut-off values to test univariate outliers. The first cut-off value is  $z \leq \pm 3.2$ , which is suggested by Tabachnick and Fidell (2007). Another cut-off value is  $z \leq \pm 4$ , which is recommended by Hair *et al.* (2010). This research adopts a  $z \leq \pm 3.2$  value that is suggested by Tabachnick and Fidell (2007). The results shown in Table 5.2 confirm that all the measured variables are in the range of  $z \leq \pm 3.2$ .

**Table 5.2: Univariate Outlier Results**

<b>Factor</b>	<b>Measured Variables</b>	<b>N</b>	<b>Mean</b>	<b>Std. Deviation</b>
PU	PU1	391	4.02	.900
	PU2	391	4.26	.779
	PU3	391	3.79	1.005
	PU4	391	4.25	.832
	PU5	391	4.16	.773
PEOU	PEOU1	391	3.90	.882
	PEOU2	391	3.99	.867
	PEOU3	391	3.90	.887
	PEOU4	391	3.97	.865
AU	AU1	391	3.69	.948
	AU2	391	4.07	.849
	AU3	391	2.12	.974
	AU4	391	4.15	.736
	AU5	391	4.09	.824
BI	BI1	391	4.16	.915
	BI2	391	3.39	1.359
	BI3	391	4.23	1.072
	BI4	391	4.21	.863
SI	SI1	391	4.04	.884
	SI2	391	4.36	.853
	SI3	391	4.00	1.028
	SI4	391	4.03	1.032
RC	RC1	391	2.24	1.018
	RC2	391	3.46	1.369
	RC3	391	1.90	1.017
	RC4	391	3.35	1.361
	RC5	391	2.14	1.131
	RC6	391	3.47	1.353
	RC7	391	3.56	1.353
	RC8	391	3.44	1.423
SE	SE1	391	3.49	1.032
	SE2	391	3.78	.951
	SE3	391	3.73	.939
	SE4	391	3.86	.926

Factor	Measured Variables	N	Mean	Std. Deviation
LG	LG1	391	2.32	1.205
	LG2	391	2.32	1.153
	LG3	391	3.67	1.406
	LG4	391	2.14	1.135
	LG5	391	2.09	1.057
TS	TS1	391	2.68	1.554
	TS2	391	2.95	1.430
	TS3	391	3.18	1.174
	TS4	391	2.99	1.429
LS	LS1	391	1.94	1.190
	LS2	391	1.99	1.186
	LS3	391	2.09	1.145
AC	AC1	391	2.78	1.385
	AC2	391	2.46	1.343
	AC3	391	2.68	1.375
C	C1	391	2.45	1.103
	C2	391	2.45	1.063
	C3	391	2.18	1.309
M	M1	391	3.83	.986
	M2	391	3.97	.936
	M3	391	3.77	.995
F	F1	391	4.13	.851
	F2	391	4.02	.859
	F3	391	4.09	.893
	F4	391	4.02	.979

The second is the multivariate outliers; AMOS was used to conduct the test of Mahalanobis Distance, degrees of freedom equal to the number of measurement variables. ( $df = 59$ ). The results obtained confirm that none of the observed values qualify as a multivariate outlier. Table 5.3 illustrates the top five highest observation values which are less than the proposed value of 4.

**Table 5.3: Results for the Multivariate Outlier for the Five Highest Observations**

Observation numbers	$(D^2/df)$
126	2.070
133	1.887
110	1.833
124	1.719
194	1.616

## 5.2 Descriptive Statistics

One of the aims of this research is to obtain data to investigate students' knowledge and experience using e-books. Descriptive statistics are used to calculate the demographic data and students' knowledge and experience on the use of e-books. Analyses of descriptive statistics are used to provide information about variance, percentage and the frequencies.

In the research survey, section A includes demographic information and students' knowledge about the e-book. Students, who have used e-books previously, will move to section B, while non-users skip directly to section C. Students who have previous experience in the use of e-books are called actual users.

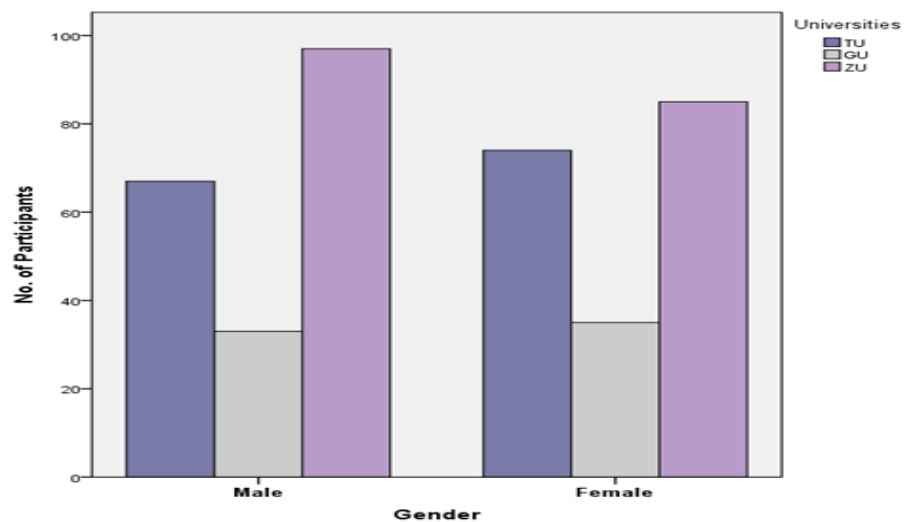
### 5.2.1 Characteristics of Sample Population

In this research, the total number of participants is 391 participants. The demographic information of the students includes their gender and the name of their university. Male and female students participating in this survey are from the three Libyan universities referred to in Chapter Four. As shown in Table 5.4 and Figure 5.1, 199 males and 192 females have participated in this survey; 45.6% from the Al- Zawia University (ZU), 36.2% from the Tripoli University (TU) and 18.2% from the Al-Jabal Al-Gharbi University (JU). The results of the descriptive statistics confirm that although the University of Tripoli is the largest participating university in terms of area and number of students, the Al-Zawia University has a larger number of participants in the survey (45.6%). However, there are only 36.2% of the participants from Tripoli University and 18.2% from Al-Jabal

Al-Gharbi University. It is worth mentioning that the percentage of participants from each university is not important, as long as the sample size required is achieved (Elkaseh *et al.*, 2014). Although the sample was randomly picked and the participation in this research was voluntary, the number of males is roughly equal to the number of female participants in this research. This can help to obtain accurate results when measuring the difference between the genders.

**Table 5.4: The Number of Participants' (Male and Female) from Each University**

The Name of Universities	Gender		Percent
	MALE	FEMALE	
Al- Zawia University (ZU)	97	84	45.6
Tripoli University (TU)	69	73	36.2
Al-Jabal Al-Gharbi University (GU)	33	35	18.2
<b>Total</b>	199	192	100



**Figure 5.1: Chart Showing the Distribution of Male and Female Participants at the Three Selected Universities**

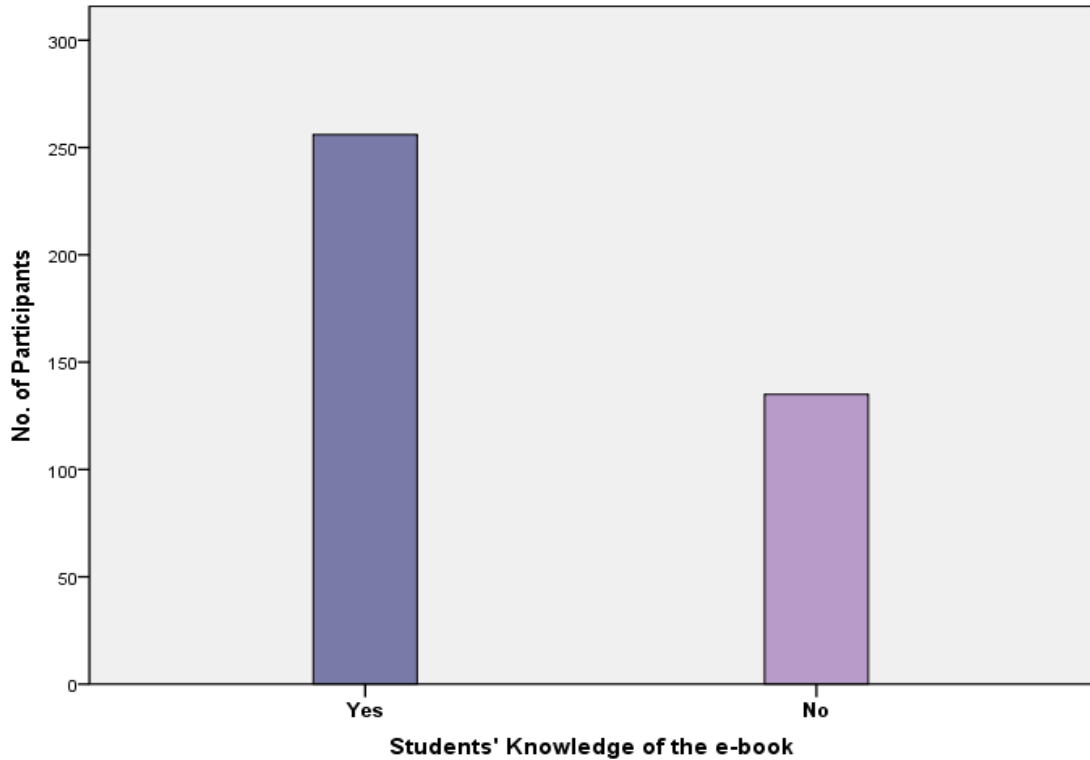


### 5.2.2 Students' Knowledge of the E-book

The demographic information for the participants includes the extent of their knowledge about the use of e-books. The primary objective of this subsection is to determine the extent of the students' knowledge and awareness toward using the e-book. As shown in Table 5.5 and Figure 5.2, 65.4% of the respondents have asserted that they have prior knowledge about e-books, whereas 34.6% of the respondents admitted that they have not heard of e-books before this survey. Although the level of student knowledge and awareness of the e-book is relatively high, the actual use of e-book for academic purposes remains the primary objective.

**Table 5.5: Students' Knowledge about the e-book**

Items	Available Options	The Number of Participants	Valid Percentage
<b>Students' Knowledge</b>	Yes	256	65.4%
	No	135	34.6%



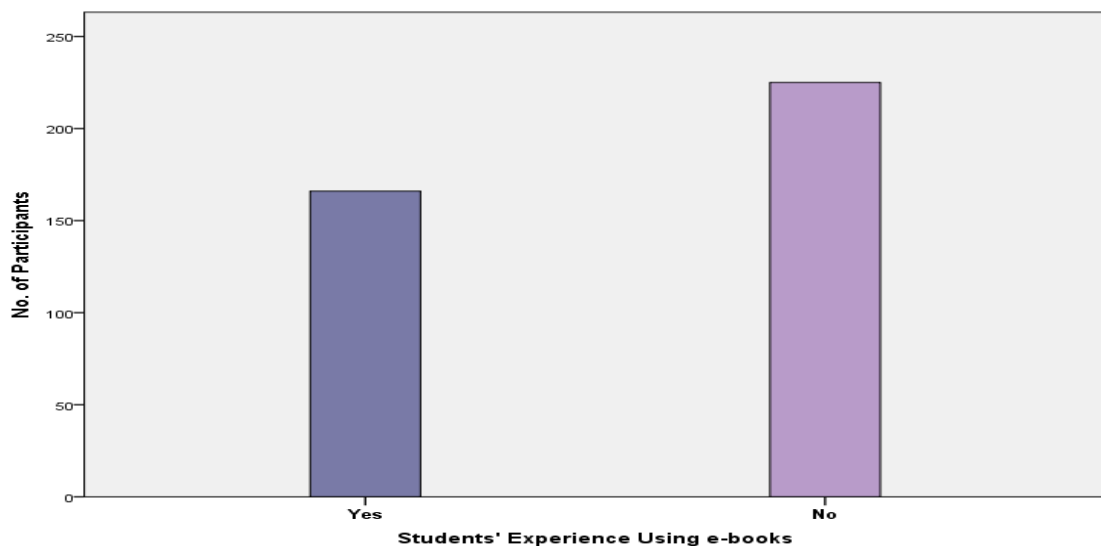
**Figure 5.2: Students' Knowledge of the e-book**

### 5.2.3 Students' Experience on the Use of the E-book

According to Table 5.6 and Figure 5.3, 57.5% of the participants do not have any previous experience on using e-books, so they did not answer the section of students' experience using e-books (Section B); they represent non-users. 42.5% of the participants used e-books in their studies. As those students answered the questions in section B, they represent the real users. Section B consists of six questions; each question has a different number of options (see Figure 1.1 for the questions). The next few subsections address only the real users. In subsections 5.2.3.3, 5.2.3.4 and 5.2.3.5, there are some students who may have chosen more than one option when answering the questionnaire, so the total number of participants may exceed the real number of students who answered these sections. The column for interpretation that presents the percent of cases is also possible to have over 100%.

**Table 5.6: Students who used e-books previously**

Items	Available Options	The Number of Participants	Valid Percentage
Current use of the e-book	Yes	166	42.5%
	No	225	57.5%



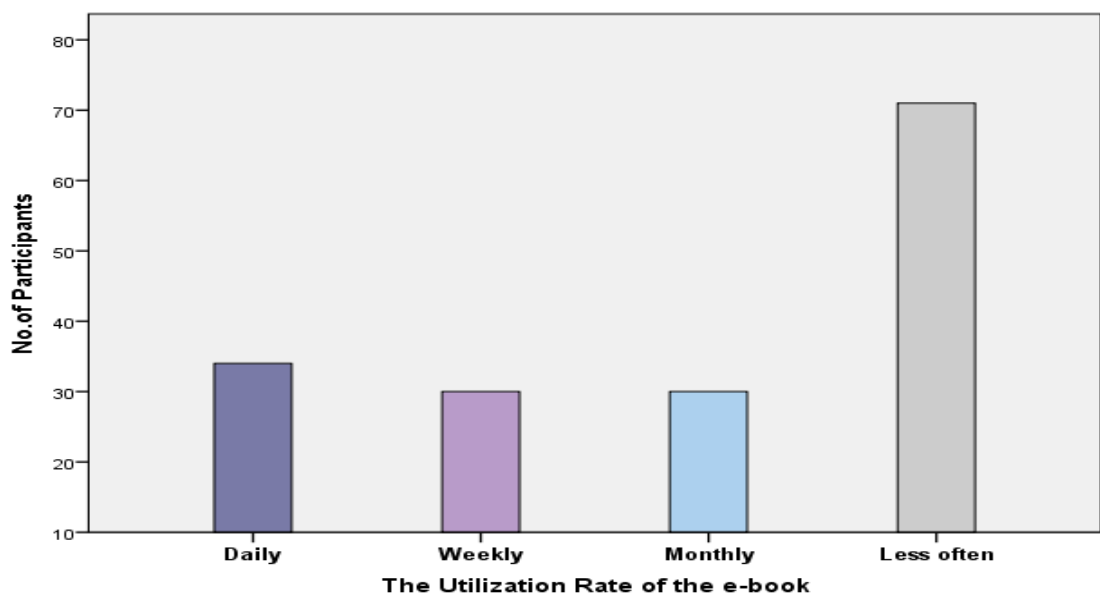
**Figure 5.3: The Number of Students who used e-books previously**

### 5.2.3.1 The Rate of Utilization of the E-book

In reference with section B in this survey, the first question was designed to determine the rate of use of e-books among MAS students. Participants were given four choices: i.e.1=Daily, 2=Weekly, 3=Monthly, 4=Less often. As shown in Table 5.7 and Figure 5.4, 21.1% of the respondents (real users) use e-books daily, 18.1% use them both weekly and monthly, whereas 42.7% of the participants use the e-book less often. The results obtained confirmed that the rate of the current use of the e-book among MAS students is not satisfactory.

**Table 5.7: The Rate of Utilisation of the e-book**

Items	The Number of Participants	Valid Percentage
Daily	35	21.1%
Weekly	30	18.1%
Monthly	30	18.1%
Less often	71	42.7%
Total	166	100%



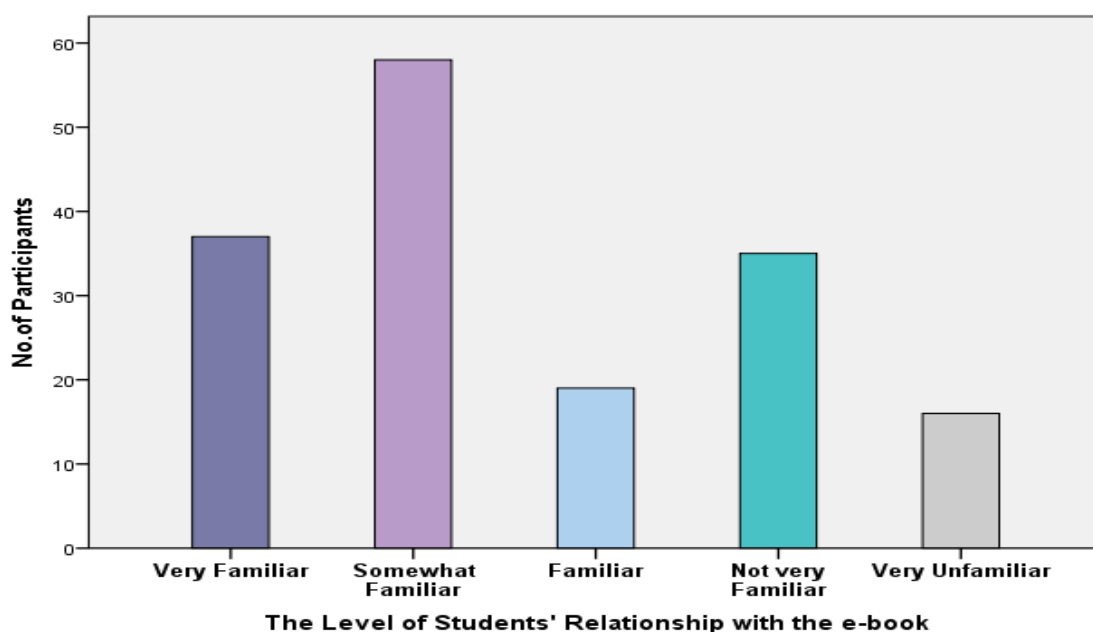
**Figure 5.4: The Rate of Utilisation of the e-book**

### 5.2.3.2 The Level of Students' Familiarity with the E-book

The second question in section B explores the level of students' relationship with the e-book. The level of students' relationship attempts to highlight the level of students' familiarity with the e-book. The participants are given five choices (i.e. 1= Very familiar, 2= Somewhat familiar, 3= Familiar, 4=Not very familiar, 5= Very unfamiliar). Based on the results shown in Table 5.8 and Figure 5.5, most of the participants are somewhat familiar with the e-book (35.2%), 22.4% are very familiar, 21.2% are not very familiar, and 11.5% are familiar. The results confirm that the students' relationship to the e-book is still not strong.

**Table 5.8: The level of Students' Relationship with the e-book**

<b>Level of Familiarity</b>	<b>The Number of Participants</b>	<b>Valid Percentage</b>
<b>Very Familiar</b>	37	22.4%
<b>Somewhat Familiar</b>	58	35.2%
<b>Familiar</b>	19	11.5%
<b>Not very Familiar</b>	35	21.2%
<b>Very Unfamiliar</b>	16	9.7%
<b>Total</b>	166	100%



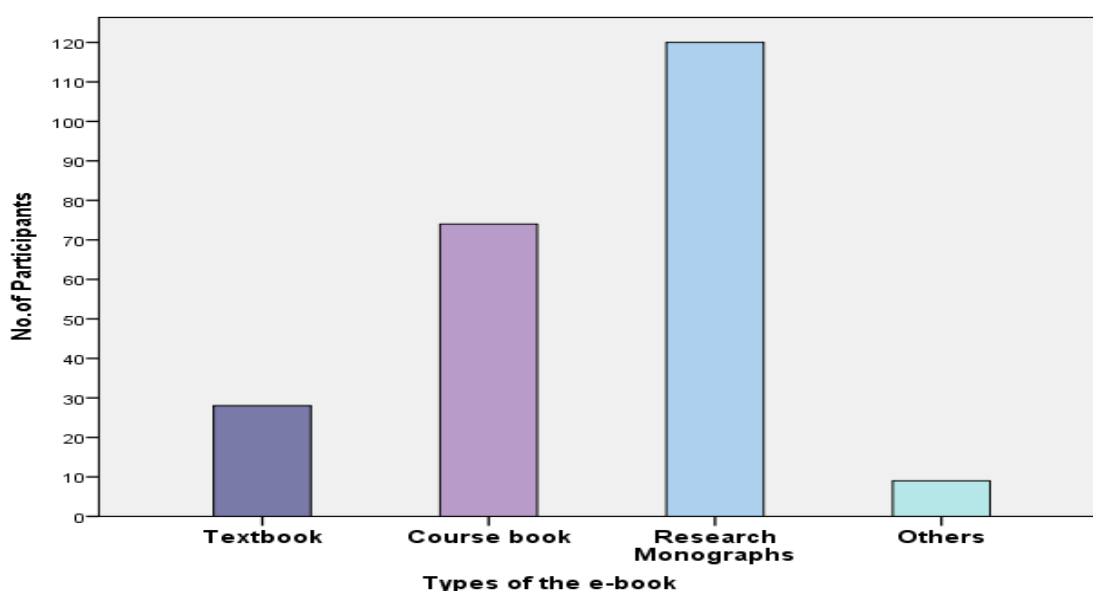
**Figure 5.5: Bar Chart Shows the Level of Students' Relationship with the e-book**

#### ***5.2.3.3 Types of E-books That Have Been Used So Far***

In the next question in section B, information about the most prevalent types of e-books used is gathered. As shown in Table 5.9 and Figure 5.6, four options are available to participants (i.e. 1=Textbook, 2=Course book, 3=Research monographs and 4=Others). Participants can choose more than one option, and they can also add any other types of e-books that are not mentioned in the options. Therefore, the total number of participants exceeds the real number of students who answered this question. The column for interpretation that presents the percent of cases is also over 100%. 72.3% of the real users selected research monographs while 44.6% selected course book when asked about the type of e-books usually used. It seems that the most important types of e-book used by students are research monographs.

**Table 5.9: Type of e-books that have been used so Far**

Available Options		The Number of Participants	Percentage of Cases
Textbook		28	16.9%
Course book		74	44.6%
Research Monographs		120	72.3%
Others	Journal	6	3.6%
	Report	3	2.4%



**Figure 5.6: Types of the e-book that have been used by the Real Users**

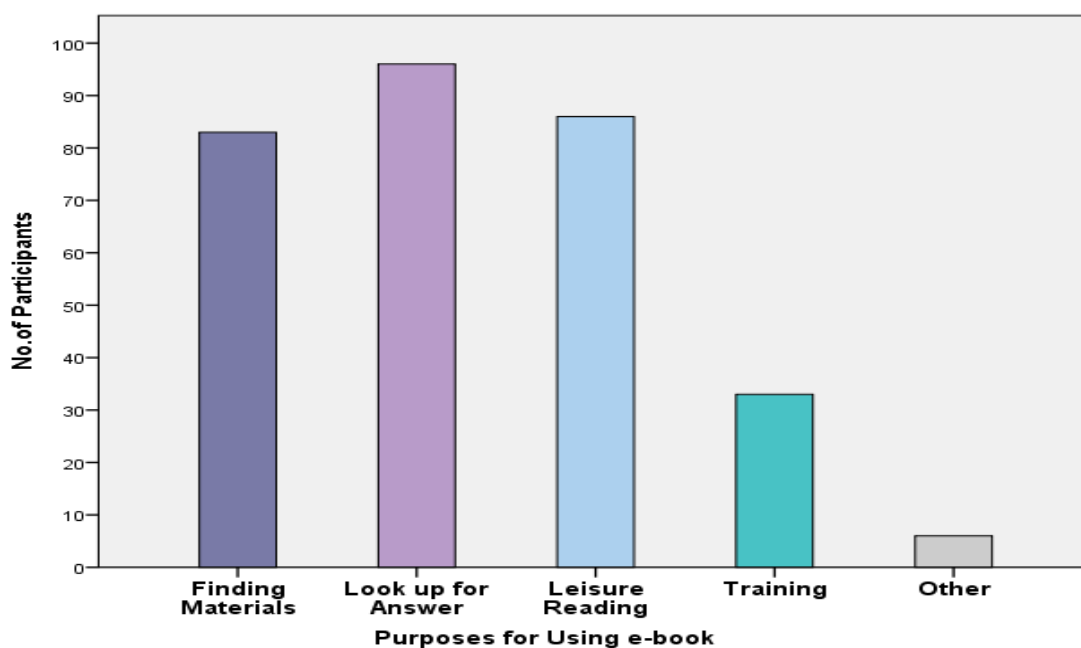
#### **5.2.3.4 The Purpose of Using E-books**

This section includes the purpose that encourages students to use e-books (see Figure 1.1). As shown in Table 5.10 and Figure 5.7, there are five choices that can be chosen by the participants (i.e. 1=Finding material, 2=Look up answer, 3=Leisure reading, 4=Training and 5= Others). The participants can also add other options, which will be calculated as additional options. For instance, 3.6% of the participants selected “for browsing” as

the main goal for using e-books. The results confirm that the e-book is not used for academic purposes most often. The search for answers and leisure reading are considered the most common goals of using an e-book.

**Table 5.10: The Main Purposes that Encouraged Students to use e-books**

Available Options		The Number of Participants	Percentage of Cases
Finding Material		83	50.3%
Look up Answer		96	57.8%
Leisure Reading		87	52.4%
Training		33	19.9%
Others	For Browsing	6	3.6%



**Figure 5.7: Bar Chart Shows the Main Purposes for Using e-book**

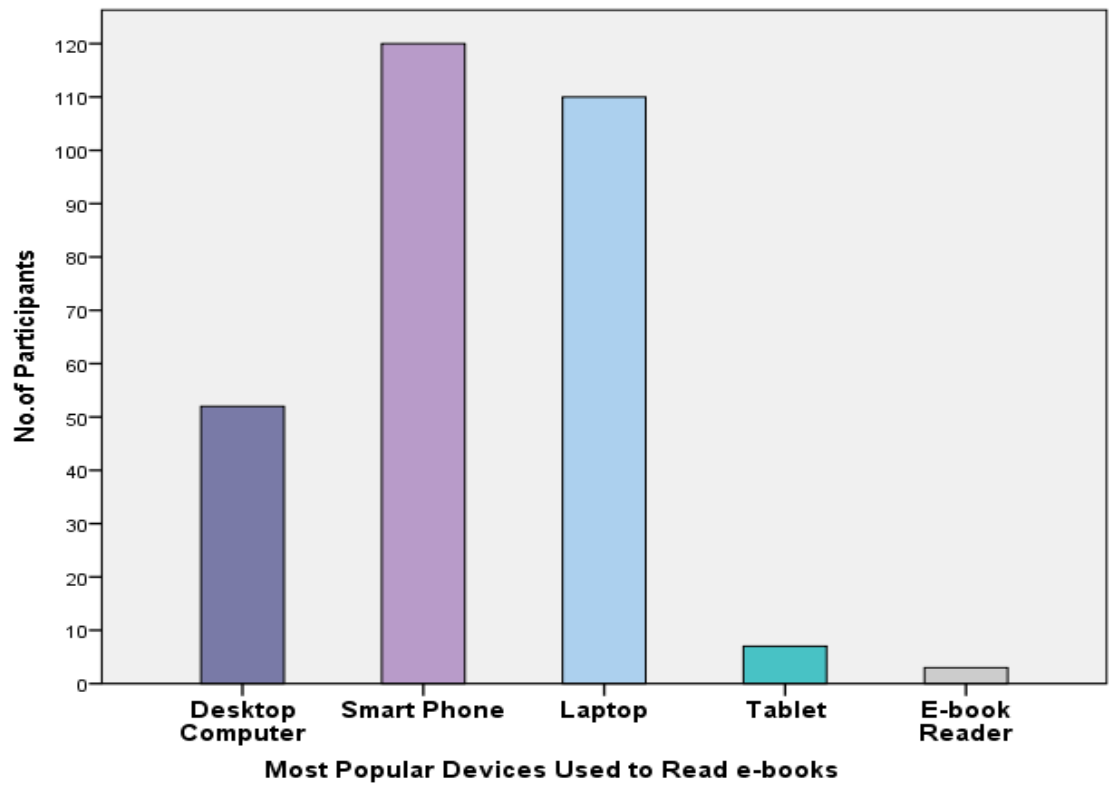
#### **5.2.3.5 Devices Most Widely Used**

In this section, six options regarding the devices most commonly used to read e-books are available to the participants (i.e. 1= Desktop computer, 2= Smart Phone, 3= Laptop, 4= Tablet, 5= E-book Readers and 6= Others). Table 5.11 and Figure 5.8 describe the participants' choices. The participants have the freedom to choose more than one option. Therefore, the total number of participants exceeds the real number of students who answered this question. The column for interpretation that presents the percent of cases is also over 100%. It is clear that the use of mobile devices for e-reading is growing rapidly, especially among young people.

**Table 5.11: Device(s) that are Currently Used**

<b>Available Options</b>	<b>The Number of Participants</b>	<b>Percentage of Cases</b>
<b>Desktop Computer</b>	52	31.3%
<b>Smart Phone</b>	120	72.3%
<b>Laptop</b>	110	66.3%
<b>Tablet</b>	7	4.8%
<b>E-book Readers</b>	3	1.8%





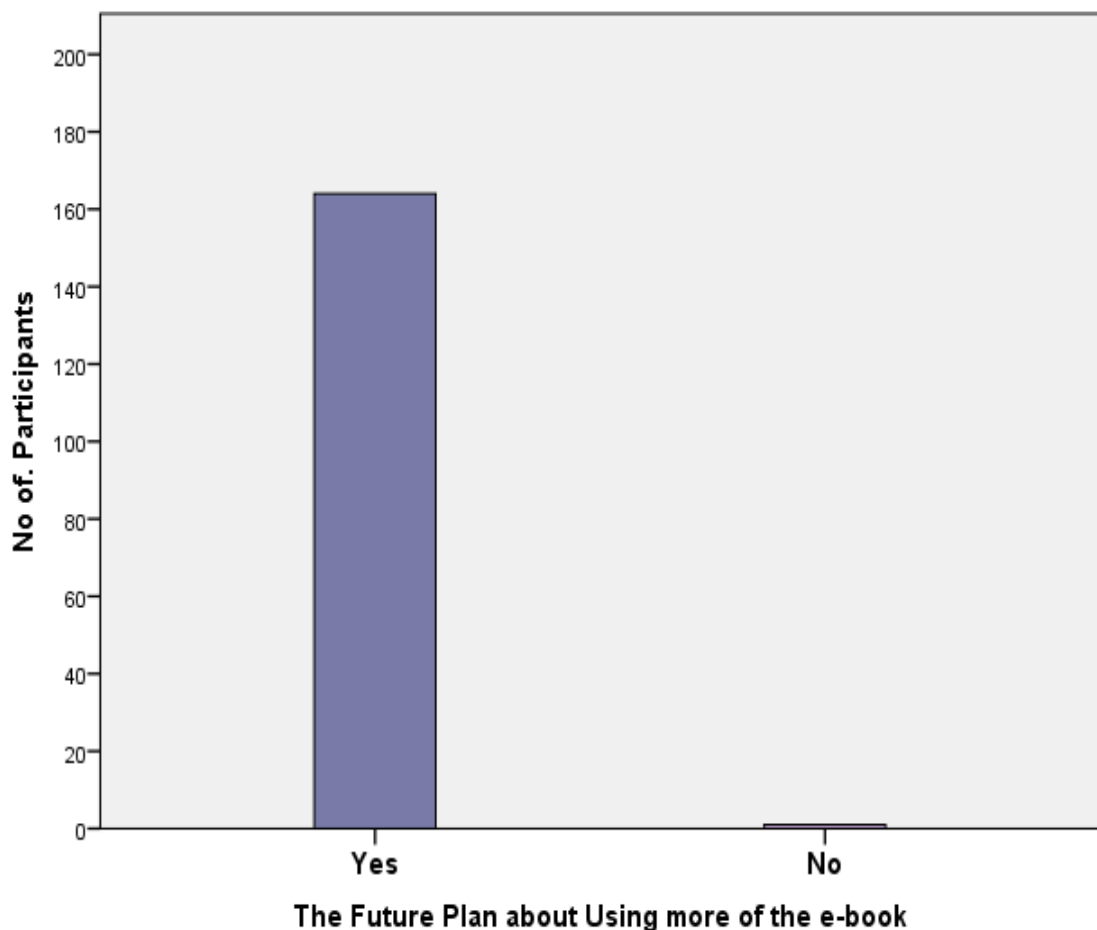
**Figure 5.8: Bar Charts Show the Most Popular Devices Used to Read e-books**

#### 5.2.3.6 The Future of E-books in Libya

Based on the result shown in Table 5.12 and Figure 5.9, the data collected in this research via the survey indicate that the majority of the participants (41.9%) who used e-books previously have decided to continue using e-books in the future too. Only one participant (0.6%) does not wish to use e-books anymore.

**Table 5.12: Students' Opinion about Using More e-books in the future**

Available Options	The Number of Participants	Valid percentage
Yes	165	99.4%
No	1	0.6%



**Figure 5.9: Bar Chart Shows Students' Opinion about Using More e-books in the Future**

### 5.3 The Measurement Model

This section addresses the measurement model for each latent and observed variable in the research model. Latent variables are those concepts that cannot be measured explicitly and typically used to explain the observed variation in behaviour (DeVault, 2016). Latent variables cannot be observed directly but can be evaluated implicitly through their relationship with the observed variables (Fornell & Larcker, 1981). The model is measured by Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). However, CFA is also a part of SEM. The subsection will address the measurement model by using EFA. CFA will be discussed in SEM section.

#### 5.3.1 Exploratory Factor Analysis (EFA)

According to Rietveld and Van Hout (1993), Exploratory Factor Analysis (EFA) includes the numerous variables that have been used to describe objects. Suhr (2006b, p. 1) also defines EFA as *“orderly simplification of interrelated measures. EFA, traditionally, has been used to explore the possible underlying factor structure of a set of observed variables without imposing a preconceived structure on the outcome”*.

EFA is a statistical technique used to explain the relations among a set of measured variables without imposing prior structure on the results. EFA is conducted using maximum likelihood with Promax rotation, to check whether the variables are loaded together as intended (Song, 2010). This is also to check whether the variables are sufficiently correlated and up to the standard of validity and reliability. The SPSS 21 has been used in this stage of data analysis.

#### 1. Reliability

The reliability of a variable-level can be defined as its stability within a single factor (Stafford *et al.*, 2004; Hair *et al.*, 2010). In this research, Cronbach's Alpha ( $\alpha$ ) is applied to evaluate the reliability of the factors. Cronbach's Alpha ( $\alpha$ ) gives a summary of the intercorrelations that occur among the factors. The variables that do not meet the criteria, such as BI2, AU3, RC1, RC3, RC5, LG1, LG3, TS1, TS3 and F4, are not incorporated in the analysis. The results are shown in Table 5.13 indicate that the Cronbach's Alpha for

each factor is higher than the normally accepted standard level of 0.70, as proposed by (Stafford *et al.*, 2004; Hair *et al.*, 2006).

**Table 5.13: The Results of the Reliability Test**

<b>Factors</b>	<b>Variable</b>	<b>Cronbach's Alpha <math>\alpha</math></b>
<b>PU</b>	PU1 PU2 PU3 PU4 PU5	0.82
<b>PEOU</b>	PEOU1 PEOU2 PEOU3 PEOU4	0.78
<b>BI</b>	BI1 BI3 BI4	0.81
<b>AU</b>	AU1 AU2 AU4 AU5	0.76
<b>SI</b>	SI1 SI2 SI3 SI4	0.83
<b>RC</b>	RC2 RC4 RC6 RC7 RC8	0.90
<b>SE</b>	SE2 SE3 SE4	0.81
<b>LG</b>	LG2 LG4 LG5	0.73
<b>TS</b>	TS1 TS4	0.93
<b>LS</b>	LS1 LS2 LS3	0.91
<b>AC</b>	AC1 AC2 AC3	0.95

<b>Factors</b>	<b>Variable</b>	<b>Cronbach's Alpha <math>\alpha</math></b>
<b>C</b>	C1 C2 C3	0.85
<b>M</b>	M1 M2 M3	0.82
<b>F</b>	F1 F2 F3	0.77

## 2. Adequacy

As mentioned in subsection 4.9.3.1, Adequacy is usually used to confirm the appropriateness of the data. The KMO and Bartlett's Sphericity tests are usually used to reveal whether can summarise the data provided by the initial variables in few factors (Anastasiadou, 2011). The KMO ranges from 0 to 1, and the accepted value is over 60% (Lowry & Gaskin, 2014). For the appropriate analysis factors, Bartlett's Test of Sphericity must be less than 0.05 (Lowry & Gaskin, 2014). As shown in Table 5.14, the KMO test result is more than 80%, and the Bartlett's for sampling adequacy is significant ( $P=0.00$ ).

**Table 5.14: KMO and Bartlett's Test**

<b>Kaiser-Meyer-Olkin Measure of Sampling Adequacy</b>		0.802
<b>The Bartlett's Sphericity test</b>	<b>Chi-Square</b>	9727.886
	<b>df</b>	1128
	<b>Sig.</b>	.000

### 3. Construct validity

Cramer and Howitt (2004) define construct validity as "*the extent to which a measure assesses the construct that it is intended or supposed to measure*". Construct validity is tested by investigating the convergent and discriminant validities (Mondi *et al.*, 2008).

#### a. Convergent Validity

The first assessment of construct validity is to check for convergent validity of a scale. This is analysed by the factors converging on a single variable which measures the same thing. The fourteen factors used in this research show convergent validity, as indicated in Table 5.15, showing high factor loadings among factors of the similar factor. According to Hair *et al.* (2006); Kannan and Narayanan (2015), the loading recorded by the variables are significant for interpreting the results if they are above the proposed standard of 0.30 for a sample size of 350 or more. Therefore, the value of 0.3 is used to determine the threshold for loading factors. The variables RC6 and RC7 have low loading factors removed from the dataset.

**Table 5.15: The Factors Loading for the Measured Variables**

Factors														
	PU	PEOU	AU	BI	SI	RC	SE	LG	TS	AC	C	M	F	LS
PU1	.597													
PU2	.735													
PU3	.571													
PU4	.800													
PU5	.728													
PEOU1		.480												
PEOU2		.518												
PEOU3		.860												
PEOU4		.743												
AU1			.571											
AU2			.721											
AU4			.669											
AU5			.636											
BI1				.782										
BI3				.776										
BI4				.736										

Factors														
	PU	PEOU	AU	BI	SI	RC	SE	LG	TS	AC	C	M	F	LS
SI1					.632									
SI2					.545									
SI3					.928									
SI4					.792									
RC2						.911								
RC4						.915								
RC8						.755								
SE1							.599							
SE2							.745							
SE3							.727							
SE4							.828							
LG2								.652						
LG4								.726						
LG5								.713						
TS2									.916					
TS4									.928					
AC1										.940				
AC2										.924				
AC3										.924				
C1											.746			
C2											.790			
C3											.868			
M1												.752		
M2												.842		
M3												.712		
F1													.719	
F2													.805	
F3													.611	
LS1														.888
LS2														.874
LS3														.818

#### b. Discriminant Validity

As mentioned in Chapter Four, there are two methods for finding discriminant validity. The first method is to test the pattern matrix, while the other assesses the factor correlation matrix. In the method of pattern matrix test, the variables should only load significantly on one factor. If the case of cross-loading exists (variable loads on multiple factors), then

the cross-loadings should vary by more than 0.2 (Gaskin, 2016a). The result obtained in Table 5.15 confirms that there are no problems in the cross-loadings matrix.

In the second method, discriminant validity can otherwise be determined by checking if cross-correlations between the indicators measuring different factors are not excessively high (Gaskin, 2016a). The correlations between the factors must not exceed 0.7 (Kline, 2015). In this case, discriminant validity will, therefore, be said to be evident if the correlations between the latent variables are only moderately strong (Hair *et al.*, 2010). Table 5.16 demonstrates that there are no correlations above 0.70, as recommended by Hair *et al.* (2010).

**Table 5.16: Factor Correlation Matrix**

Factor	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.0													
2	.11	1.0												
3	-.14	-.15	1.0											
4	.12	.20	.10	1.0										
5	.03	.23	-.26	-.06	1.0									
6	.27	.15	-.10	.21	.06	1.0								
7	.08	.26	-.32	-.03	.45	.06	1.0							
8	.09	.11	-.07	.19	.03	.16	-.05	1.0						
9	.48	.20	-.14	.26	.05	.44	.13	.13	1.0					
10	.39	.10	-.22	.26	.05	.22	.13	.15	.39	1.0				
11	.09	.30	-.04	.15	.05	.11	.02	.15	.21	.13	1.0			
12	.54	.20	-.18	.29	.02	.41	.06	.17	.55	.45	.11	1.0		
13	.24	.08	-.05	.16	-.06	.34	-.03	.35	.30	.25	.06	.28	1.0	
14	.49	-.23	-.31	-.13	.39	.05	.28	-.19	-.05	-.16	.05	.07	-.11	1.0

NOTE: 1=RC, 2=PU, 3=AC, 4=TS, 5=C, 6=LS, 7=SI, 8=M, 9=PEOU, 10=BI, 11=SE, 12=F, 13=AU, 14=LG.

## 5.4 Structural Equation Modelling (SEM)

Structural Equation Modelling process is carried out through two approaches, namely, the measurement model and structural model analysis. Many researchers have suggested using these two approaches to building models (Anderson & Gerbing, 1988; Mulaik *et al.*, 1989). According to DeVault (2016), the measurement model addresses the



relationships between the observed and latent variables, while the structural model includes only the relationships between the latent variables.

#### **5.4.1 Confirmatory Factor Analysis (CFA)**

Confirmatory Factor Analysis (CFA) provides an avenue to test how well the measured factors represent a smaller number construct (Hair *et al.*, 2010). The adequacy of the measurement models is assessed through six standards for goodness-of-fit, reliability and constructs validity of the research model. The initial measurement models of the present research are shown in Figure 5.10.

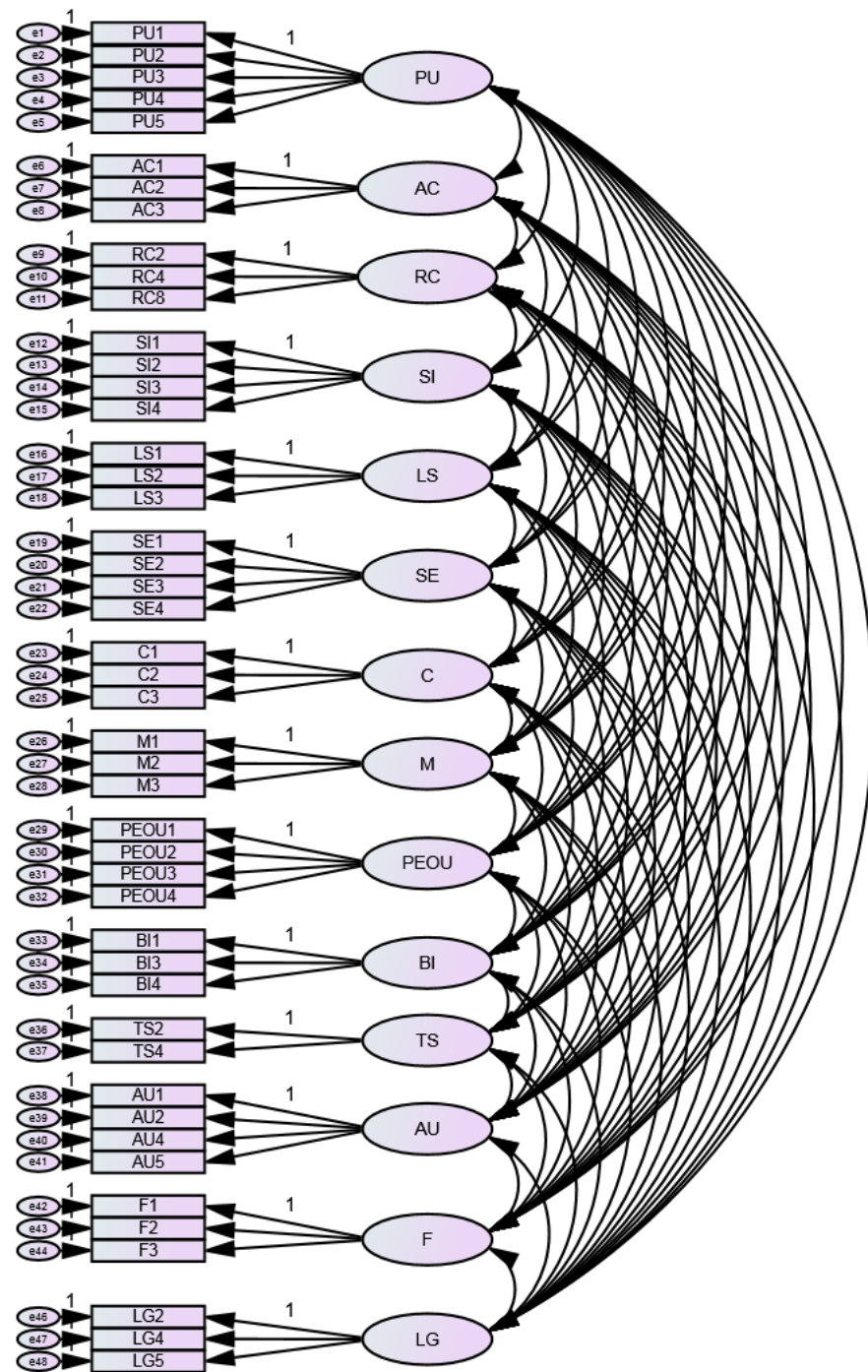


Figure 5.10: The Initial Measurement Model in IBM AMOS (Version 22)

## 1 Goodness-of-Fit Measures (GOF)

In investigating the goodness-of-fit of the measurement model in the presented research, six measures have been selected to evaluate the validity of the developed model. They are namely Chi-Square Test ( $\chi^2$ ), Goodness-of-fit Index (GFI) and Adjusted Goodness-of-fit index (AGFI), Root mean square error of approximation (RMSEA), Standardized root mean residual (SRMR), Comparative fit index (CFI) and Tucker-Lewis index (TLI) (Hair *et al.*, 2010). These measures are the most famous and widely used. However, some measures that are sensitive to large samples, such as the normed chi-square (NC), was not selected (Sharma *et al.*, 2005; Lomax & Schumacker, 2012; Al-Aulamie, 2013). Subsection 4.9.3.1 includes the detailed explanation to the goodness-of-fit model. Figure 5.11 shows the initial measurement model, while Table 5.17 shows the indicators of goodness-of-fit for the initial measurement models. The  $\chi^2$  square is 1.36, which is less than the suggested value ( $<3.0$ ); the CFI is 0.80, which is less than the recommended value ( $<0.9$ ); RMSEA and SRMR are 0.03 and 0.04 respectively, which are less than the recommended value ( $<0.08$ ); the result of TLI, being 0.77, is not in the recommended range ( $>0.8$ ) and GFI is less than 0.9. However, the results are expected due to the complexity of the model. There is a decrease in the goodness-of-fit index used because it is sensitive to the sample size and complexity of the model (Sharma *et al.*, 2005; Al-Aulamie, 2013). The AGFI is advised to be used in the case of complex models, where the value of AGFI recommended by Al-Aulamie, (2013) is 0.80 or more ( $AGFI > 0.8$ ). The value of the AGFI obtained is 0.83.

**Table 5.17: The Research Model Fit Summary**

Model Fit indicators	Criteria	Value	References
$\chi^2/df$	$<3.0$	1.36	(Madigan, Goodfellow, & Stone, 2007)
CFI	$>0.9$	0.80	(Tatham & Black, 1998)
RMSEA	$<0.08$	0.03	(Hair <i>et al.</i> , 2010)

<b>SRMR</b>	<0.08	0.04	(Hu & Bentler, 1999; Kenny, 2011)
<b>TLI</b>	>0.8	0.77	(Janssens <i>et al.</i> , 2008; Hair <i>et al.</i> , 2010)
<b>GFI</b>	Near to 0.9	0.86	(Al-Aulamie, 2013)
<b>AGFI</b>	>0.8	0.83	Hair et al., 1995

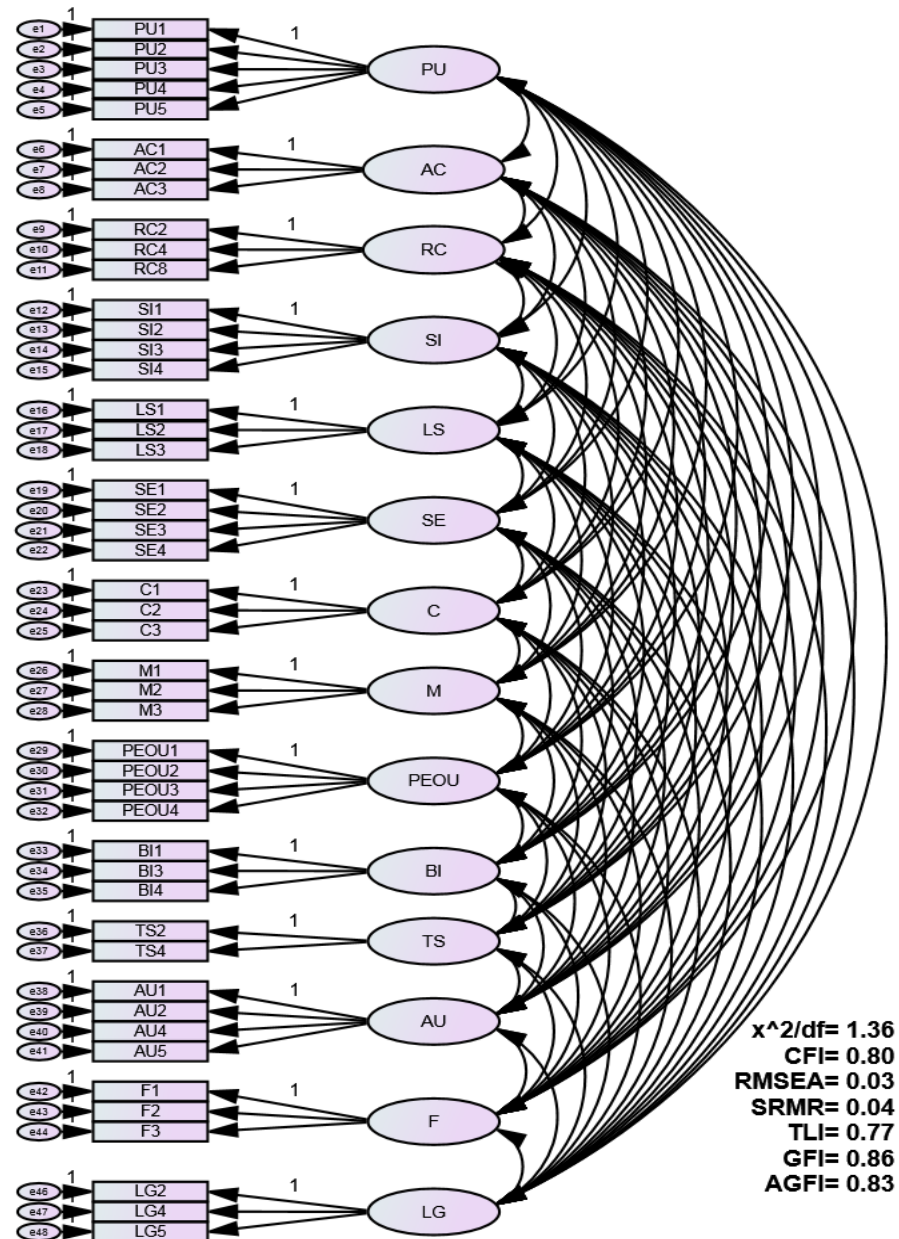


Figure 5.11: The Goodness-of-fit Results of the Measurement Model

In achieving the model fit measurement, there are two methods that can be used to improve the model result over the CFI, TLI and GFI measures.

1. The Squared Multiple Correlations (SMCs): to improve the developed model validity in this research, the measured variables that have a value lower than the recommended value (lower than 0.5) becomes a candidate for removal (Hair et al., 2010). Table 5.18 shows the variables that have low SMCs. The variables AU2, PEOU1, LG2, LG4, PU3 and SE1 were excluded. The factor of language was also excluded because it cannot be measured by only one variable. In Table 5.19 and Figure 5.11, the measurement model gave better results over all of the goodness-of-fit measures after the six measured variables were removed.
2. Factor loading: the factor loadings should be more than 0.5 or the variable must be removed. CFA was used to compute the factor loadings. The results in Table 5.19 and Figure 5.12 show that one measured variable, which is PEOU1 (PEOU1<0.5), has a low factor loading. PEOU1 is then removed.

**Table 5.18: Squared Multiple Correlations**

Variable	Extraction Value
AU2	0.31
PEOU1	0.37
LG2	0.48
LG4	0.49
PU3	0.37
SE1	0.46

**Table 5.19: Refined Model Fit Summary Comparison**

Model Fit indicators	Criteria	Value	References
$\chi^2/df$	<3.0	1.56	Madigan <i>et al.</i> (2007)
CFI	>0.9	0.96	Tatham and Black (1998)

<b>RMSEA</b>	<0.08	0.04	Hair et al., (2010)
<b>SRMR</b>	<0.08	0.04	Kenny, 2011; Hu & Bentler, (1999)
<b>TLI</b>	>0.8	0.95	Hair et al., (2010); Janssens et al., (2008)
<b>GFI</b>	Near to 0.9	0.89	Schumacker & Lomax, (2010)
<b>AGFI</b>	>0.8	0.86	Hair et al., (1995)

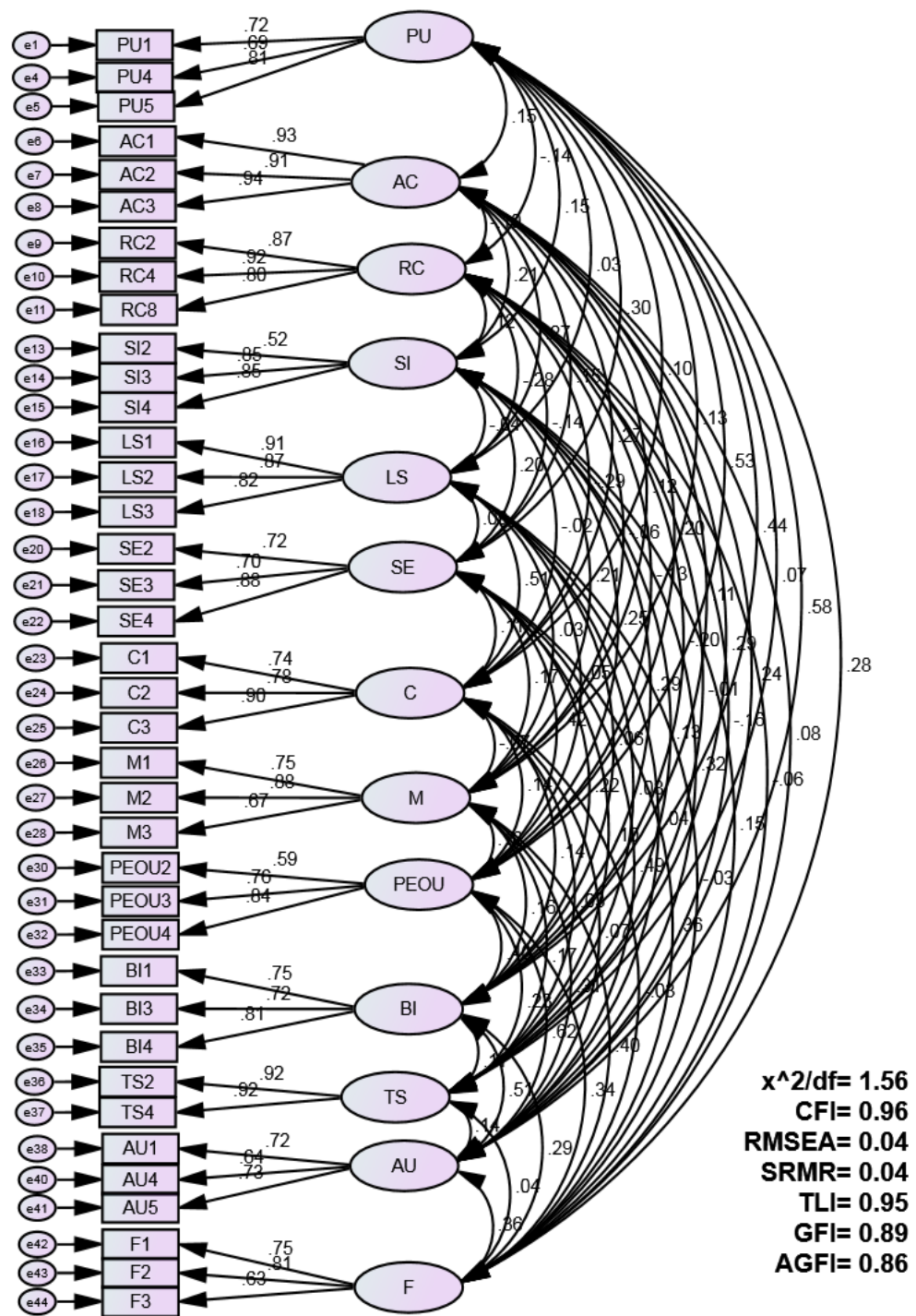


Figure 5.12: The Initial Measurement Model after Removing Some Variables

## 2 Validity and Reliability

Validity is a very important criterion to find out the convergent and discriminant validities, and the same is also true for the reliability of the measurement model. Composite Reliability (CR), Average Variance Extracted (AVE) and Maximum Shared Variance (MSV) are the important measures used for testing the constructs' validity and reliability (Cramer & Howitt, 2004). The construct validity of the measurement model is examined by testing the convergent and discriminant validities.

- **Convergent Validity**

Convergent validity is described by Cramer and Howitt (2004, p. 38) as "*the extent to which a measure is related to other measures which have been designed to assess the same construct*". The value of AVE and CR can be used to measure convergent validity (Hair et al., 2010). Dividing the total of all squared standardised factors loading by the number of measured variables gives the AVE value. Hair *et al.* (2006) suggest that for convergent validity to be satisfactory, the value of AVE should be 0.5 or higher, while the recommended value for CR by Hair et al. (2010) is 0.7 or more for good reliability. Table 5.20 clarifies that the convergent validity for each factor in the measurement model in this research was achieved because the value of AVE for each factor is located within the recommended range. The results in Table 5.20 also confirm that all of the factors have achieved a good reliability.

**Table 5.20: Criteria for Convergent' Validity**

<b>Factor</b>	<b>CR</b>	<b>AVE</b>	<b>MSV</b>
<b>AU</b>	0.74	0.50	0.39
<b>PU</b>	0.79	0.55	0.33
<b>AC</b>	0.95	0.86	0.09
<b>RC</b>	0.90	0.75	.09
<b>SI</b>	0.80	0.57	0.10
<b>LS</b>	0.90	0.75	0.25
<b>SE</b>	0.81	0.59	0.24
<b>C</b>	0.85	0.65	0.26
<b>M</b>	0.82	0.60	0.16
<b>PEOU</b>	0.78	0.54	0.38



<b>BI</b>	0.80	0.58	0.26
<b>TS</b>	0.92	0.85	0.09
<b>F</b>	0.78	0.54	0.16

- **Discriminate Validity**

Discriminate validity helps to check the degree to which a variable is very distinct from other variables. Awang (2012); Al-Hadad (2015); Kannan and Narayanan (2015) suggest that in testing the discriminate validity of the developed model, the AVE values of each factor should be compared to the MSV. Based on the result shown in Table 5.20, the value of AVE has to be higher than the MSV to ensure discriminate validity. Discriminate validity can also be measured by considering the correlation between the factors (Hair et al., 2010). To confirm the discriminate validity, Berteau and Zait (2011) recommend that the square root of every AVE value belonging to each factor should be larger than any correlation among any pairs of factors. Tables 5.20 and 5.21 confirm that all the results obtained are achieved, and the level of discriminant validity is satisfactory. The value of AVE for each factor is more than the MSV to the same factor. Also, the value of the square root of AVE from a factor is higher than the correlation shared among the factors and other factors in the research model. The main diagonal represents the square roots of AVE.

**Table 5.21: Criteria for Discriminant Validity**

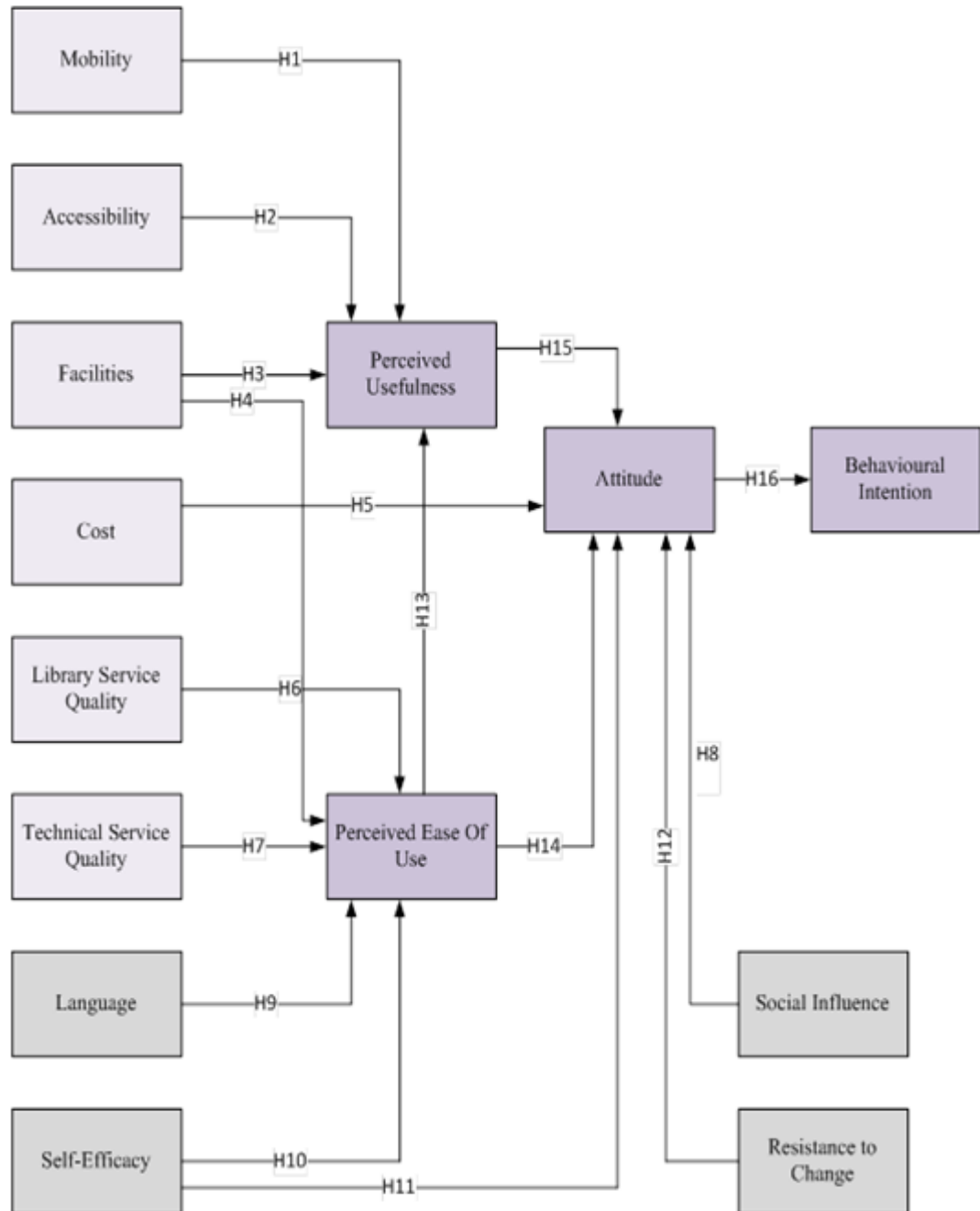
<b>Factor</b>	<b>AU</b>	<b>PU</b>	<b>AC</b>	<b>RC</b>	<b>SI</b>	<b>LS</b>	<b>SE</b>	<b>C</b>	<b>M</b>	<b>PEOU</b>	<b>BI</b>	<b>TS</b>	<b>F</b>
<b>AU</b>	<b>.70</b>												
<b>PU</b>	.58	<b>.74</b>											
<b>AC</b>	.24	.15	<b>.93</b>										
<b>RC</b>	- .16	-.14	-.10	<b>.87</b>									
<b>SI</b>	.32	.16	.21	.12	<b>.76</b>								
<b>LS</b>	.04	.03	.27	- .28	- .04	<b>.87</b>							
<b>SE</b>	.49	.30	.15	- .14	.20	.09	<b>.77</b>						
<b>C</b>	.07	.10	.27	- .29	- .02	.51	.10	<b>.81</b>					
<b>M</b>	.31	.13	.12	- .06	.21	.03	.17	-.07	<b>.78</b>				

<b>PEOU</b>	.62	0.53	.20	- .13	.25	.05	.42	.14	.16	<b>.73</b>			
<b>BI</b>	.51	0.44	.11	- .20	.29	.06	.22	.14	.16	.40	<b>.76</b>		
<b>TS</b>	.14	.07	.30	- .01	.13	.08	.10	.03	.17	.23	.12	<b>.92</b>	
<b>F</b>	.36	0.28	.08	- .06	.15	- .03	.36	-.03	.40	.34	.29	.04	<b>.73</b>

**Note:** the main diagonal represents the square roots of AVE, whereas the other matrix entries represent the factors' correlations.

#### 5.4.2 Structural Model

The testing of the structural model is the step that comes after the completion of the evaluation of the measurement model (Khodabandelou *et al.*, 2014; Hair *et al.*, 2010). As mentioned in section 5.4, the relationships between the latent and observed variables are tested in the measurement model, whereas the structural model only tests the relationships between the latent variables (Fornell & Larcker, 1981). The structural model hypotheses are tested using three criteria, which are GOF, the Significance of Estimated Model Coefficients and the Explanation Power of the Variance in the dependent variables. Figure 5.13 clarifies the developed model in this research and the relationships between the factors represent the research hypotheses. Figure 5.14 shows the developed model representation in IBM AMOS.



**Figure 5.13: The Developed Model Hypotheses**

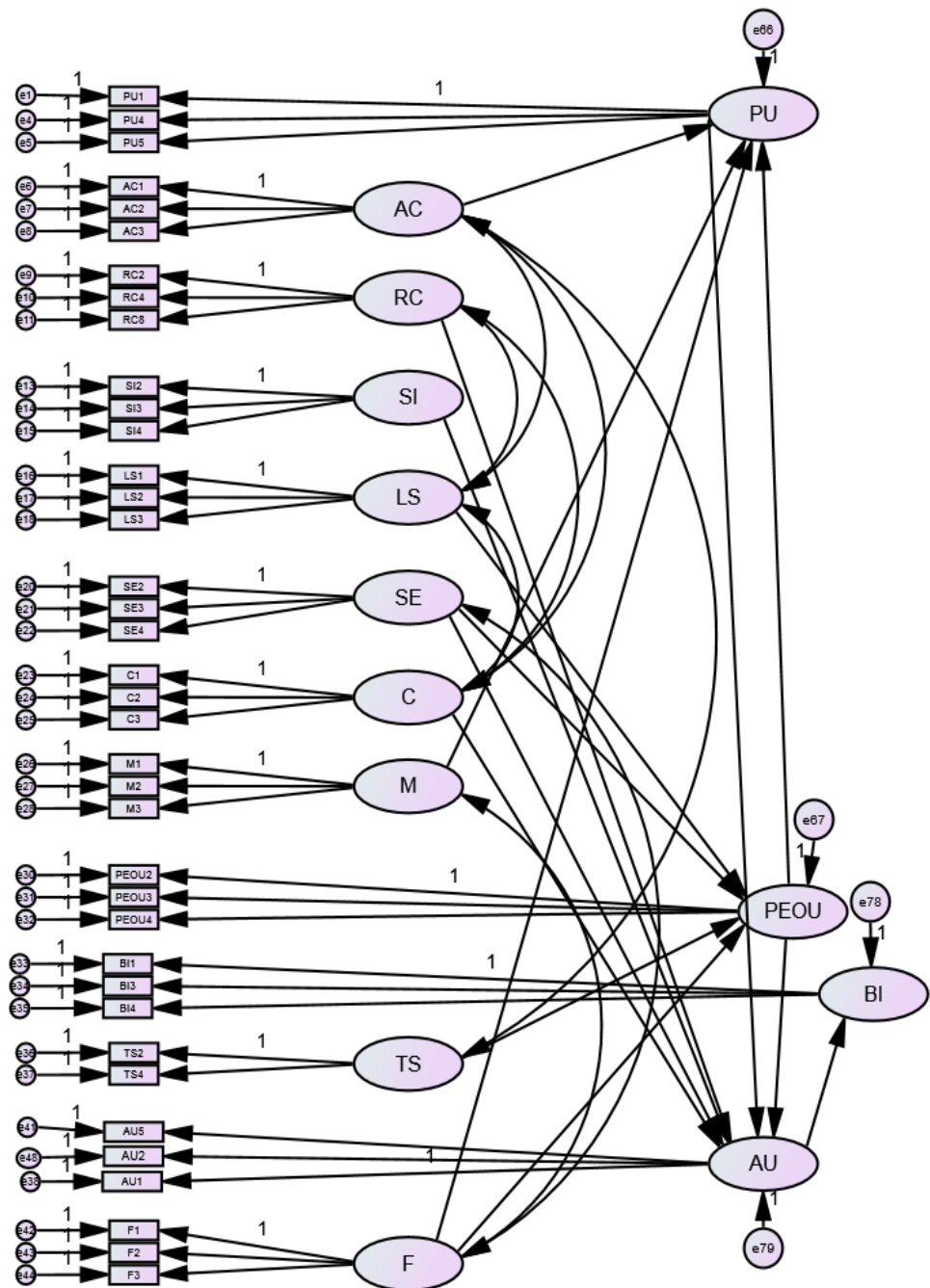


Figure 5.14: The Developed Model Representation in IBM AMOS

#### 5.4.2.1 The Fit of the Structural Model

The criteria that were used for the measurement model were used again to measure the Goodness-Of-Fit (GOF) for the structural model. The results obtained (CFI, TLI, and GFI) are satisfactory and emphasises an acceptance of the structural model. Based on the results obtained in Table 5.22, the  $\chi^2$  square is 1.36, which is less than 3; CFI is 0.95, which is within the recommended value ( $<0.9$ ); RMSEA and SRMR are 0.04 and 0.05 respectively, which are less than the recommended value of 0.08; the result of TLI, which is 0.95, is in the range recommended ( $>0.8$ ); GFI is very close to the recommended value of 0.9 and this result recommended to be acceptance by Ong and Lai (2006); Arteaga Sánchez, Duarte Hueros, and García Ordaz (2013); Lee, Hsiao, and Purnomo (2014); the AGFI is 0.88 and the recommended cut-off value for AGFI values is that of being above 0.80 (Al-Aulamie, 2013). All the results are within the commonly accepted thresholds, as recommended by previous literature. Thus, the fit indicators confirm that the research model has a good fit to the data.

**Table 5.22: The Research Model Fit Results**

<b>GOF</b>	<b>Criteria</b>	<b>The Result of the Research Model</b>	<b>References</b>
$\chi^2/\text{df}$	$<3.0$	1.70	Madigan <i>et al.</i> (2007)
<b>CFI</b>	$>0.9$	0.95	Tatham and Black (1998)
<b>RMSEA</b>	$<0.08$	0.04	Hair et al., (2010)
<b>SRMR</b>	$<0.08$	0.05	Kenny, 2011; Hu & Bentler, (1999)
<b>TLI</b>	$>0.8$	0.95	Hair et al., (2010); Janssens et al., (2008)
<b>GFI</b>	Near to 0.9	0.88	Schumacker & Lomax, (2010)
<b>AGFI</b>	$>0.8$	0.85	Hair et al., (1995)

#### 5.4.2.2 Analysis of Path Coefficients

The estimation of the path coefficients are usually used to determine the strengths of the relations between the independent and dependent variables. The hypotheses shown in Table 5.23 are examined using Path Analysis via Regression Weights for the parameters (estimate). Standardised Path Coefficients (SE) between the models constructs the significance of the Estimated Coefficients (Critical Ratio) and Probability Value (p-value). In accepting the hypothesis, the probability value must be in the following range:  $-0.5 \leq p - value \leq 0.05$ . The Critical Ratio (t-values) is obtained by dividing the values of path by their standard errors (Abbad *et al.*, 2009a). It has been used for testing whether the path values are significantly different from zero (Abbad *et al.*, 2009a). The path values are significantly different from zero if the Critical Ratio is more than +1.96, or less than -1.96 (two tails) and therefore, the significance level is  $-0.05 \leq p - value \leq 0.05$ . Otherwise, the hypothesis will be rejected. Table 5.23 shows that the estimation by Standardised Path Coefficients (Estimate), Standard Error (SE), Critical Ratio (t-values), p-value and hypotheses results. The hypotheses that met the criteria are illustrated in bold.

**Table 5.23: Results of Path Tests**

Hypothesis	Path			Estimate	SE	t-values	<i>p</i> – value	Hypothesis Result
H1	M	→	PU	0.01	0.05	0.14	0.89	Not Sig.
H2	AC	→	PU	0.03	0.03	1.00	0.32	Not Sig.
H3	F	→	PU	0.12	0.07	1.69	.09	Not Sig.
<b>H4</b>	<b>F</b>	→	<b>PEOU</b>	<b>0.18</b>	<b>0.05</b>	<b>3.41</b>	<b>***</b>	<b>Sig</b>
H5	C	→	AU	-0.05	0.05	-1.01	0.31	Not Sig.
H6	LS	→	PEOU	0.01	0.03	0.45	0.65	Not Sig.
<b>H7</b>	<b>TS</b>	→	<b>PEOU</b>	<b>0.07</b>	<b>0.02</b>	<b>3.26</b>	<b>***</b>	<b>Sig</b>
<b>H8</b>	<b>SI</b>	→	<b>AU</b>	<b>0.31</b>	<b>0.08</b>	<b>3.63</b>	<b>***</b>	<b>Sig</b>
H9	LG	→	PEOU	-	-	-	-	Excluded
<b>H10</b>	<b>SE</b>	→	<b>PEOU</b>	<b>0.24</b>	<b>0.05</b>	<b>4.84</b>	<b>***</b>	<b>Sig</b>
<b>H11</b>	<b>SE</b>	→	<b>AU</b>	<b>0.18</b>	<b>0.06</b>	<b>3.03</b>	<b>***</b>	<b>Sig</b>
<b>H12</b>	<b>RC</b>	→	<b>AU</b>	<b>-0.08</b>	<b>0.03</b>	<b>-2.54</b>	<b>**</b>	<b>Sig</b>
<b>H13</b>	<b>PEOU</b>	→	<b>PU</b>	<b>0.60</b>	<b>0.10</b>	<b>6.27</b>	<b>***</b>	<b>Sig</b>
<b>H14</b>	<b>PEOU</b>	→	<b>AU</b>	<b>0.45</b>	<b>0.10</b>	<b>4.28</b>	<b>***</b>	<b>Sig</b>
<b>H15</b>	<b>PU</b>	→	<b>AU</b>	<b>0.45</b>	<b>0.08</b>	<b>5.75</b>	<b>***</b>	<b>Sig</b>
<b>H16</b>	<b>AU</b>	→	<b>BI</b>	<b>0.53</b>	<b>0.07</b>	<b>7.65</b>	<b>***</b>	<b>Sig</b>

Notes: (\*\*\*=p-value< 0.001, \*\*=p-value<0.01;\*=p-value<0.05)

#### 5.4.2.3 Variance Explained

The third estimation process is used to define whether the research model has the ability to explain the variation in the dependent variables (PU, PEOU, AU and BI). The squared multiple correlations  $R^2$  can be used to measure the ability of the structural model to explain the variance in the dependent variables in this research. Based on the results mentioned in Figure 5.15, M, AC, F and PEOU explain 30% of the variance in PU, while the factors of F, SE, TS, LS could explain 29% of the variance in PEOU. The factors of SE, SI, RC, C, PU and PEOU explain about 60% of the variance in students' AU towards using the e-book. The structural model in this research can account for 40% of the variability in the BI of students towards the usage of the e-book.

## 5.5 Hypotheses Testing

The developed model in the present research consists of fourteen factors. The relationships between these factors represent the research model hypotheses that are subjected to measurement. Table 5.24 shows the developed model hypotheses.

**Table 5.24: Developed Model Hypotheses**

Hypothesis Number	The Hypothesis of the Research		
H1	M	→	PU
H2	AC	→	PU
H3	F	→	PU
H4	F	→	PEOU
H5	C	→	AU
H6	LS	→	PEOU
H7	TS	→	PEOU
H8	SI	→	AU
H9	LG	→	PEOU
H10	SE	→	PEOU
H11	SE	→	AU
H12	RC	→	AU
H13	PEOU	→	PU
H14	PEOU	→	AU
H15	PU	→	AU
H16	AU	→	BI

According to the hypotheses results that have been shown in Table 5.23, Figures 5.15 and 5.16, ten hypotheses were accepted, while four hypotheses were rejected. Only one hypothesis (H9) has been excluded from not meeting the terms of statistical analysis.

Based on the results of a causal relationship with the estimated path coefficients and the critical ratio (t-test), all the hypotheses of the TAM constraints were accepted ( $-0.05 \leq p - value \leq 0.05, -1.96 \geq t \geq +1.96$ ). PEOU has a strong impact on PU towards using e-books (H13) and also, a strong direct impact on AU of e-books (H14) ( $\beta = 0.48, p - value \leq 0.001, t = 6.27$  and  $\beta = 0.33, p - value \leq 0.001, t = 4.28$  respectively). Moreover, PU (H15) has a significant influence on AU towards using e-books ( $\beta = 0.42, p - value \leq 0.001, t = 5.75$ ). Finally, AU towards using e-books (H16) has the strongest determinate on BI to adopt e-books ( $\beta = 0.53, p - value \leq 0.001, t = 7.65$ ).



Second, all of the hypotheses of intrinsic factors were accepted except one, which was ruled out for statistical reasons. SE (H10), (H11) and RC (H12) hypotheses were accepted. SE has a direct impact on PEOU of the e-book (H10) and students' AU (H11) ( $\beta = 0.32, p - value \leq 0.001, t = 4.84$  and  $\beta = 0.18, p - value \leq 0.001, t = 3.03$ ), whereas RC hypothesis has a direct negative impact on students' AU ( $\beta = -0.13, p - value \leq 0.05, t = -2.54$ ).

Finally, just three hypotheses from the extrinsic factors group were accepted, while five were rejected. SI (H8) is hypothesised to have a direct positive impact on students' AU ( $\beta = 0.20, p - value \leq 0.001, t = 3.63$ ) and it is accepted. The hypothesis of F (H4) is accepted to have a positive impact of the F factor on PEOU of the e-book ( $\beta = 0.22, p - value \leq 0.001, t = 3.41$ ); whereas F was rejected toward PU (H3). The results show that the hypothesis (H7) tests the impact of TS on PEOU of e-books and it is accepted ( $\beta = 0.18, p - value \leq 0.001, t = 3.26$ ).

However, M (H1), AC (H2) and C (H5) have a  $p - value$  higher than the recommended value ( $-0.05 \leq p - value \leq 0.05$ ). Based on the results shown in Figures 5.15 and 5.16, the hypothesis of LS (H6) upon PEOU of the e-book is also rejected).

Table 5.25 shows the important factors in each group. The intrinsic factors seem to have a stronger influence on the acceptance of the e-book than the extrinsic factors.

**Table 5.25: The Strongest Factors in Each Group**

<b>Intrinsic Factors</b>	<b>Regression Weights (<math>\beta</math>)</b>	<b>Extrinsic Factors</b>	<b>Regression Weights (<math>\beta</math>)</b>
SE	0.32	F	0.22
RC	-0.13	SI	0.20
		TS	0.18

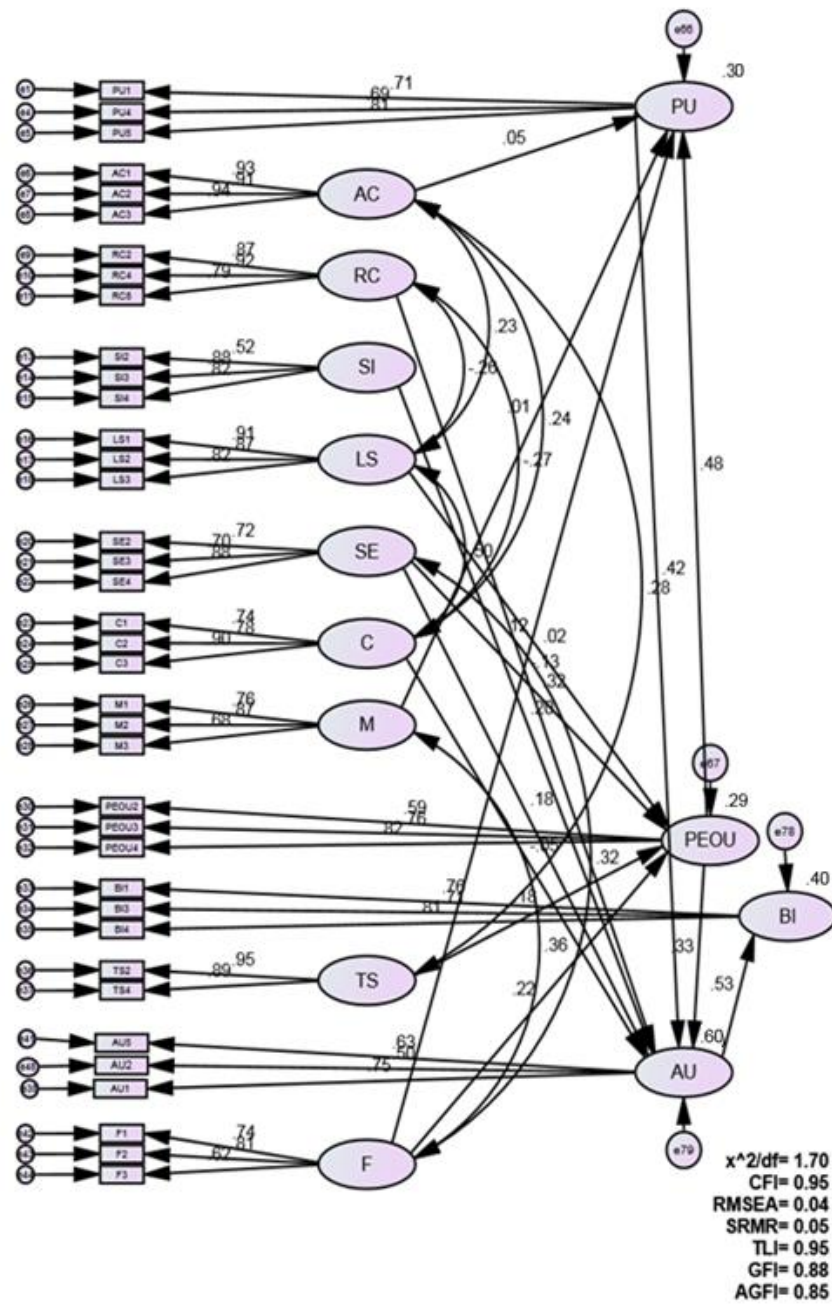
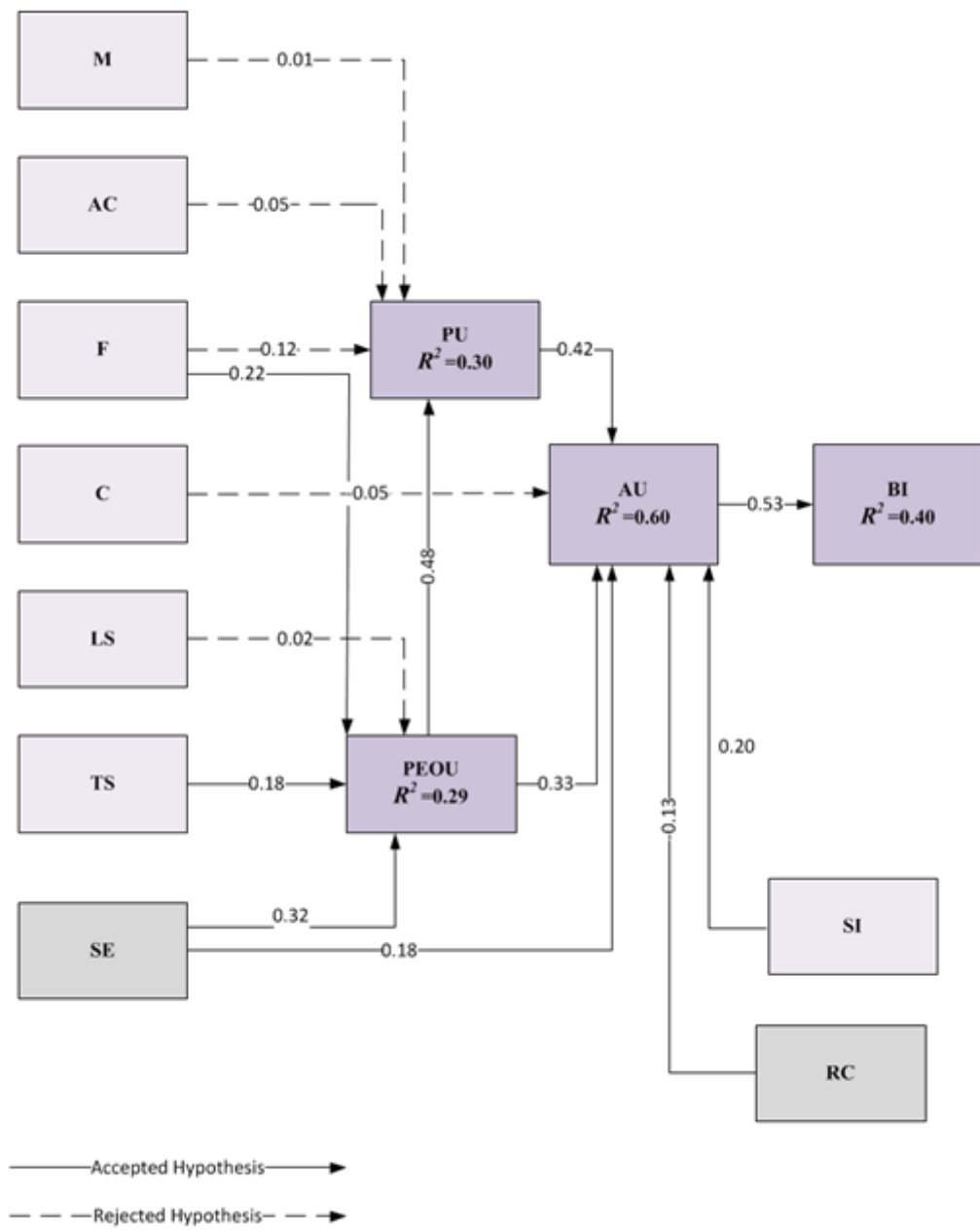


Figure 5.15: Structural Model Results



**Figure 5.16: The Developed Model Results**

## 5.6 Total Effect

As mentioned in section 4.10, there are two types of effects in the path model: direct and indirect. The total effect is the sum of the direct and indirect effects. When the independent variable or even the dependent variable does not have an indirect effect on the dependent variable through the mediator variable (i.e.  $LS \rightarrow PEOU$ ,  $PEOU \rightarrow PU$ ), the total effect is equal to a direct effect. Otherwise, some of the indirect effects are equal to the total effect, when there is no direct impact of these variables (i.e.  $PEOU \rightarrow BI$ ,  $PU \rightarrow BI$  and  $SE \rightarrow BI$ ). Based on Table 5.26, AU, PEOU, PU and SE are identified as the important predictors to students' BI, according to the total effect estimates. PEOU, PU, SI and SE also appear as good predictors to the students' AU. F only has an indirect effect on students' AU. Although the total effect of F on PEOU is fairly good, the direct effect of F is insignificant, while PEOU is a good predictor of PEOU. There are no indirect effects to the factors on PEOU; therefore, the total effect of TS, F and SE factors is the same as the direct effect.

**Table 5.26: Indirect and Total Effect**

Dependent Variables	Determinant	Direct Effect	Indirect Effect	Total Effect
PU ( $R^2 = 0.30$ )	PEOU	0.48	-	0.48*
	M	0.01	-	0.01
	AC	0.05	-	0.05
	F	0.12	0.11	0.23**
	SE	-	0.16	0.16
	LS	-	0.01	0.01
	TS	-	0.09	0.09
PEOU ( $R^2 = 0.29$ )	TS	0.18	-	0.18**
	F	0.22	-	0.22**
	SE	0.32	-	0.32**
	LS	0.02	-	0.02
AU	PEOU	0.33	0.20	0.53*

Dependent Variables	Determinant	Direct Effect	Indirect Effect	Total Effect
$(R^2 = 0.60)$	PU	0.42	-	0.42*
	C	-0.05	-	-0.05
	RC	-0.13	-	-0.13
	SI	0.20	-	0.20**
	SE	0.18	0.17	0.35**
	LS	-	0.01	0.01
	F	-	0.17	0.17**
	C	-0.05	-	- 0.05
	TS	-	0.10	0.10
	AC	-	0.02	0.02
BI $(R^2 = 0.40)$	AU	0.53	-	0.53*
	C	-	-0.03	-0.03
	F	-	0.09	0.09**
	SE	-	0.20	0.20**
	AC	-	0.01	0.01
	SI	-	0.11	0.11**
	LS	-	0.01	0.01
	TS	-	0.05	0.05
	RC	-	-0.07	-0.07
	PEOU	-	0.28	0.28**
	PU	-	0.22	0.22**

\* Significant effects, \*\* moderate effects

## 5.7 Estimation

As mentioned in section 4.11, path analysis is a type of a multivariate procedure that is used to test the dependent and independent variables. The coefficient of determination ( $R^2$ ) is the most important criterion used in statistical analysis to assess the model's ability to explain and predict future results. It is also used as a guide to measure the accuracy of

the model. The path model showed in Figure 5.14 can be specified by the following path equations:

Equation (1) shows the direct relationships between the dependent variable (PEOU) and independent variables (F, SE, and TS).

$$\text{PEOU} = 0.22 F + 0.32 \text{SE} + 0.18 \text{TS} \dots\dots\dots(1)$$

$$R^2 = 0.29$$

Equation (2) offers a direct relationship between the dependent variable (PU) and the other dependent variable (PEOU), while Equation (3) represents the indirect effect of independent variables (F, SE, and TS) on the dependent variable (PU). The indirect relationship with independent variable (F, SE, and TS) can be calculated through the mediator variable (PEOU). In most models, it is simpler not to deal with the parameters themselves, but to work to reduce the coefficients of the model instead (Kenny, 1997). In reducing the coefficients of the model, the structural equations are expressed solely in terms of the independent variables. Sometimes this is the easiest solution to reduce the form coefficients of the model and then solve for the path coefficients. The reduced coefficient form for PEOU is not a single path coefficient but a function of coefficients.

$$\text{PU} = 0.48 \text{PEOU} \dots\dots\dots(2)$$

$$R^2 = 0.30$$

$$\text{PU} = 0.48(0.22 F + 0.32 \text{SE} + 0.18 \text{TS})$$

$$\text{PU} = 0.11F + 0.16\text{SE} + 0.09\text{TS} \dots\dots\dots(3)$$

In the same way, the reduced form coefficient for AU is not a single path coefficient but a function of coefficients. Equations (4) and (5) show the direct and indirect effects of the dependent variables (PEOU, PU) and independent variables (F, SE, TS, SI, and RC) on students' AU respectively.

$$\text{AU} = 0.33\text{PEOU} + 0.42\text{PU} + 0.20 \text{SI} + 0.18\text{SE} - 0.13 \text{RC} \dots\dots\dots(4)$$

$$R^2 = 0.60$$

$$AU = 0.33(0.22F + 0.32SE + 0.18TS) + 0.42(0.11F + 0.15SE + 0.09TS) + 0.20SI + 0.18SE - 0.13RC$$

$$AU = 0.07F + 0.11SE + 0.05TS + 0.10F + 0.06SE + 0.04TS + 20SI + 0.18SE - 0.13RC$$

$$AU = 0.17F + 0.35SE + 0.10TS + 20SI - 0.13RC \dots\dots\dots(5)$$

$$BI = 0.53 AU \dots\dots\dots(6)$$

$$R^2 = 0.40$$

$$BI = 0.53 (0.17F + 0.35SE + 0.10TS + 0.20SI - 0.13RC)$$

$$BI = 0.10F + 0.20SE + 0.05TS + 0.11SI - 0.10RC \dots\dots\dots(7)$$

In Equation (6), the student's BI can be estimated through the direct effect of students' AU, whereas Equation (7) explains the student's BI across the indirect effect of independent variables through the mediator variable (PU, PEOU, and AU).

## 5.8 The Moderating Effect of Gender

This research has utilised multi-group analysis to explore the moderating impact of gender on the relationship between the constants in the developed model. The measurement and structural model tests are used to examine the measurement and structural models in this research. First, the measurement model (Figure 5.11) is tested for the differences between the genders in terms of the measured variables (dependent and independent variables). In addition, the structural model (Figure 5.13) is also tested for the differences between the genders in term of the hypotheses.

### 5.8.1 The Measurement Model Test

Chi-square has been computed in the measurement model (Figure 5.11) before and after the process of weight constraints to the measured variables. Based on the results obtained in Table 5.27, there is no significant difference at the model level between the male and female groups (chi-square  $\Delta\chi^2 = 85.22$  and  $\Delta df = 76$ ). This means that the genders'

perceptions towards the measured variables are similar. The chi-Square distribution table is a common method used to decide if the  $\Delta x^2$  result is significant or not.

**Table 5.27: The Chi-square  $\Delta x^2$  for the Measurement Model**

Measurement model	$\chi^2$	Degree of freedom ( <i>df</i> )
Unconstrained Model	2607.76	1761
Constrained Model	2692.98	1873
The difference in chi-square $\Delta x^2$	85.22	76

### 5.8.2 The Structural Model Test

Chi-square has been calculated before the process of weight limitations of the research hypothesis. This same process is also applied after weight constraints to the hypotheses. As shown in Table 5.28, there is no significant difference amongst the two gender groups at the model level. However, they may be different at the path level. Therefore, the identification of the hypothesis has been determined by repeating the method of weight constraints on each hypothesis separately and computing the difference in chi-square ( $\Delta x^2$ ) again. Based on the results shown in Table 5.28, three hypotheses are significantly different between the genders. The factor of F is the main factor that is hypothesised to have an impact on PU. The two groups have different perceptions towards F (H3). Moreover, the hypothesis for SE toward AU (H10) is accepted in the case of females and rejected by the males. The factor of TS is statistically different between the males and females (H7). Based on the results shown in the structural model test, the  $R^2$  (explained variance) of PU, PEOU, AU and BI is totally different between the males and females (Table 5.30, Figure 5.17 and 5.18).

**Table 5.28: The Chi-square ( $\Delta x^2$ ) for the Structural Model**

Structural Model	$\chi^2$	Degree of freedom ( <i>df</i> )
Unconstrained Model	2965.65	1944
Constrained Model	3030.91	2012
The difference in chi-square	65.26	68



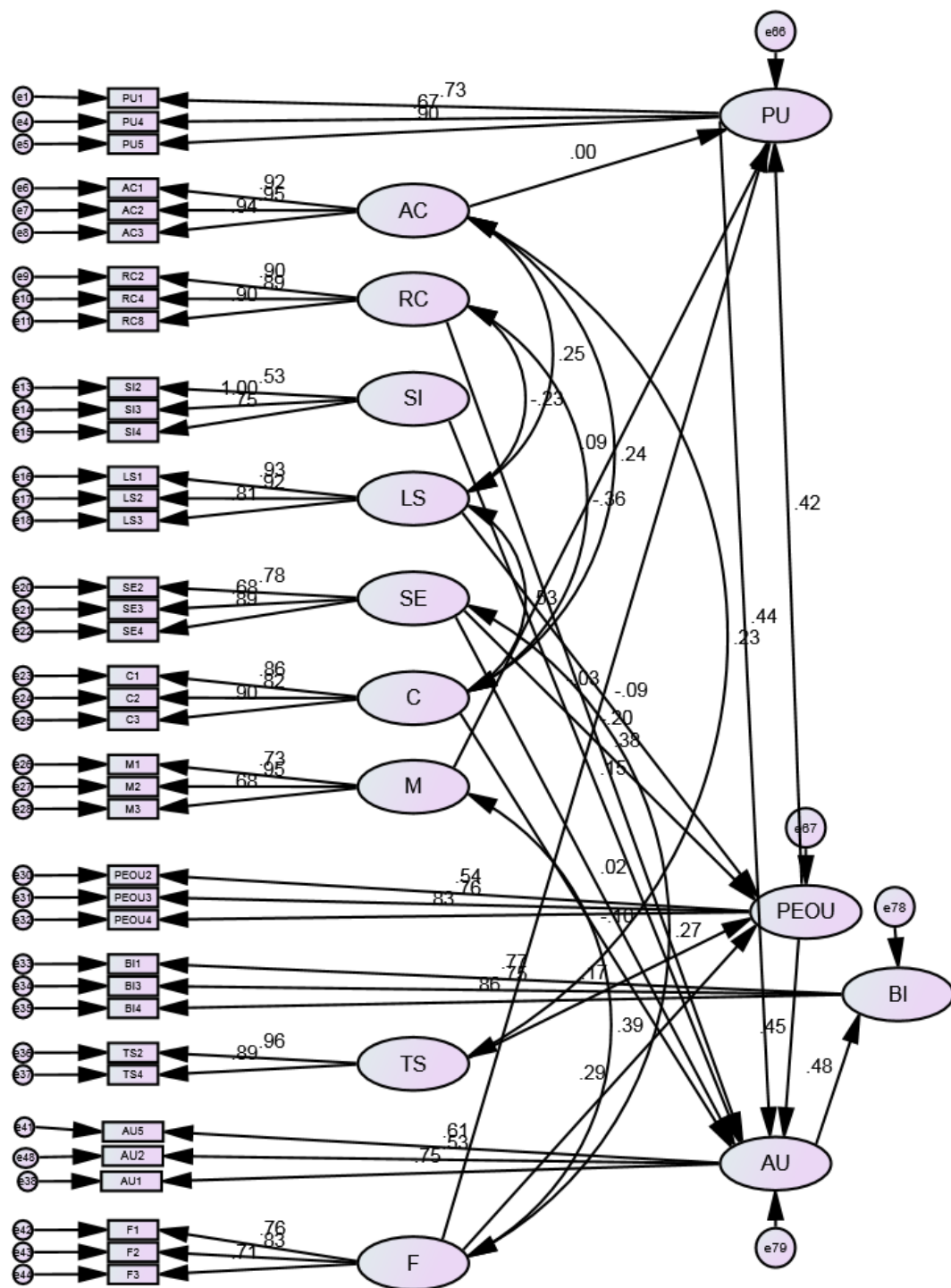


Figure 5.17: The Structural Model Results for Males

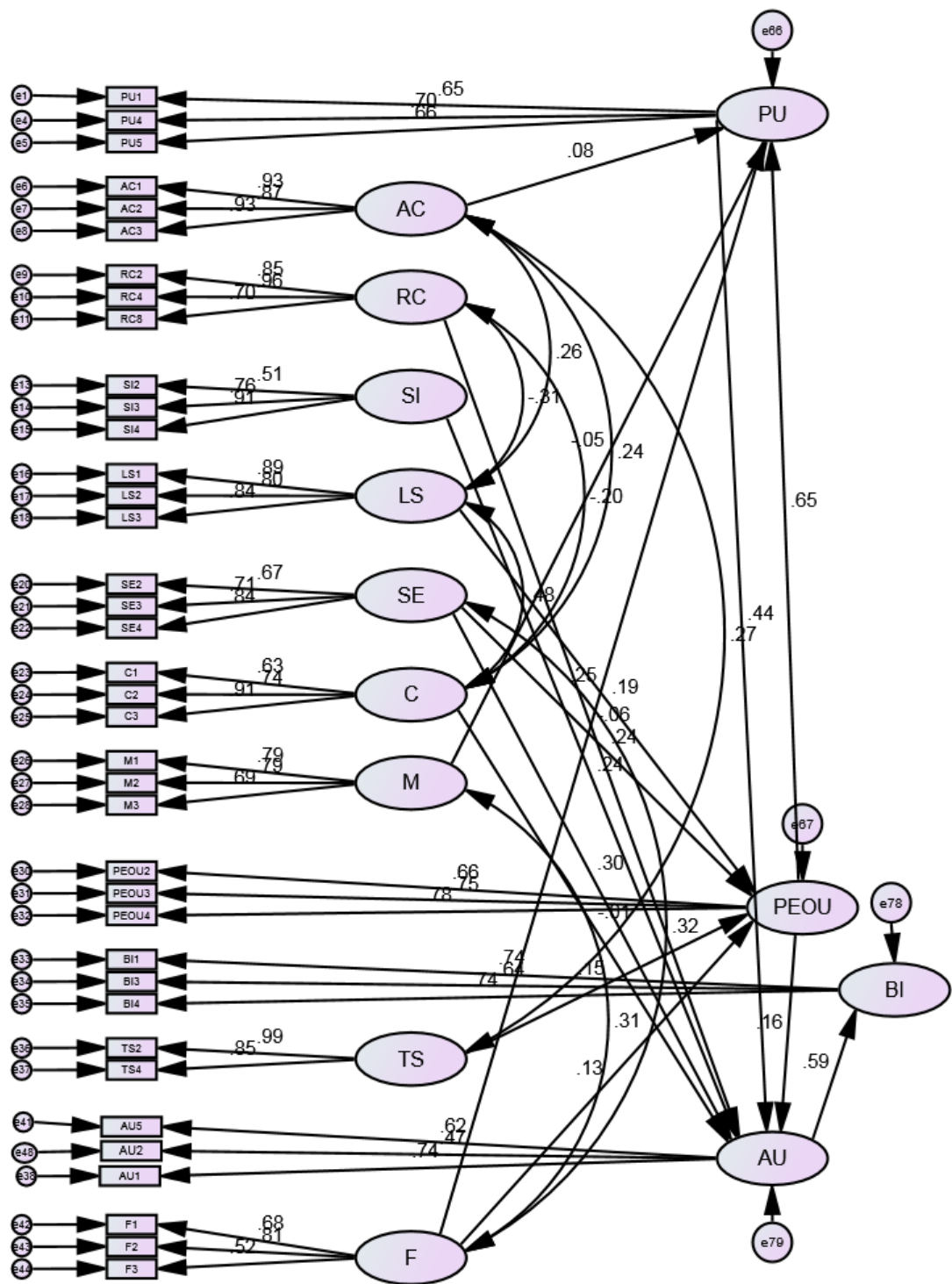


Figure 5.18: The Structural Model Results for Females

**Table 5.29: The Significantly Different Hypotheses between the different genders**

Hypothesis	Path			Male			Female		
				Standardised coefficient	t-values	p-value	Standardised coefficient	Critical Ratio	p-value
H3	F	→	PU	- 0.03	- 0.26	0.800	0.25	2.58	**
H10	SE	→	AU	0.02	0.30	0.770	0.30	3.38	***
H7	TS	→	PEOU	0.17	2.19	*	0.060	1.84	0.070

**Table 5.30: The Explained Variance for the Dependent Variables between Genders**

Gender	PU	PEOU	AU	BI
Male	0.18	0.33	0.63	0.34
Female	0.55	0.25	0.56	0.40

## 5.9 Summary

This chapter provides a detailed explanation of the data analysis process, the model measurements and the result of the hypotheses. Statistical Package for the Social Sciences (SPSS) was used to analyze data in the descriptive statistical section and measurement the research model. Furthermore, Structural Equation Modelling (SEM) was used to measure a model fit and examine the research hypotheses.

The statistical analyses are divided into five sections. The first section includes data screening. Data screening is the first step taken to make sure that data which has been collected is clean, useful and valid for testing. In this step, many problems such as missing data, normality and outliers are treated. After the process of screening data, the data are ready for the process of statistical analysis. The second section focuses on descriptive statistics. Descriptive statistics are used to describe the demographic information of

students, as well as to explain the extent of current use of e-books and students' knowledge and experience towards the usage of the e-book.

The measurement model is discussed in the third section and includes specifically the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). In this section, the reliability, adequacy and construct validity of the measurement model is determined. The results of the reliability and construct validities of the measurement model are satisfactory and appropriate for the testing of the structural model. Model fit is also tested at this stage, based on the criteria described in Chapter Four. The fourth section in the data analysis processes involves the structural model. This section presents the assessments of the structural model. In this section, the research hypotheses are tested using three criteria, namely Goodness-Of-Fit (GOF), the Significance of Estimated Model Coefficients and the Explanation Power of the Variance in the dependent variables. The criteria that have been used in the measurement model are used again to measure the GOF for the structural model. All the results obtained are within the recommended range. Ten hypotheses are supported, while four are rejected. Only one hypothesis has been excluded as a result of statistical reasons. The ability of the model to explain variance in the dependent variables is also determined. Finally, this chapter also investigates the moderating impact of gender on the relationships amongst the factors affecting the acceptance of e-books among MAS students. It provides a better understanding of e-book acceptance between male and female students taking Mathematics and Statistics at universities in Libya. The results obtained in this chapter are further discussed in Chapter Six.

## **6 Chapter Six: Discussion**

### **6.0 Overview**

This chapter discusses the research results as reported in the thesis. The research findings are divided into seven sections. Section 6.1 discusses the results of the descriptive statistics, which answers the first research question that was addressed in section 1.4. Section 6.2 includes the development model results that are responsible for deciding whether to accept or reject the research hypotheses. Section 6.2 answers the second research question, reported in section 1.4. Section 6.3 includes the discussion of the role of the extrinsic and intrinsic factors that are described in subsections 4.3.1 and 4.3.2. Section 6.4 indicates the ability of the developed model to explain the variance. In section 6.5, the results of the moderating effect of gender are discussed in the last section of the chapter. Section 6.6 includes a summary of this chapter.

### **6.1 Discussion of the Results of Descriptive Statistics**

This section provides the answer to the first question as indicated in the first chapter. This question includes the MAS students' knowledge and experience towards the use of the e-book. Based on the results obtained in subsection 5.2.2, the level of students' knowledge and awareness of the e-book has been relatively high. This may be a good indicator of the spread of awareness and knowledge about the use of e-books among MAS students. This result is considered somewhat encouraging because knowledge is classified as the most prominent obstacle that may prevent the use of an e-book. According to Sago (2013) and Abdullah and Gibb (2006), the lack of knowledge is one of the most important reasons that lead to the non-use of e-books among the students. The lack of knowledge is also reported by Gunter (2005).

Despite the high proportion of students' knowledge and awareness about the e-book, the percentage of its use among MAS students is still very low. According to the results obtained in subsection 5.2.3.1, the rate of the current use of the e-book among MAS students is not satisfactory, even among those participants who claim to actually use e-books. It is

frustrating that even students who make up the real users of the e-book admitted the scarcity used when they were asked about the rate of their use of the e-book. In fact, these results are not a surprise; especially since the statistics provided by some publishers, such as Springer, have shown that the acceptance rate of e-books among MAS students is very low, compared to other students in other disciplines (Letchumanan & Tarmizi, 2011b; Letchumanan & Muniandy, 2013). Letchumanan and Tarmizi (2010) also confirm the low use of e-books among Mathematics students at Putra Malaysia University (UPM). Nevertheless, the reduced use of the e-book is not limited to MAS students only; many studies have confirmed the decline in the use of the e-book among students in various disciplines. For example, although the results are influenced by the increased exposure to computers and Information Technology among the computer science and information technology participants of the survey (by Roesnita and Zainab (2013)), the level of use of the e-book is also very low.

This stage includes the real users of e-books who participated in this survey, which addresses their experience and relationship with the e-book. According to the results obtained in subsection 5.2.3.2, the rate of the participants' familiarity with e-books is still unsatisfactory. Most of the real users of the e-book are somewhat familiar with the e-book, while a few of them are very familiar. However, this percentage is still low; especially as the questions are directed to the category of participants who have actually used e-books. These results are supported by Letchumanan and Tarmizi (2010); Johnson and Buck (2014), where they confirm that the majority of the participants are not familiar with e-books. Woody *et al.* (2010, p. 947) also report that:

*"It is becoming quite clear that, despite the ubiquity of computers and interactive technology in their lives, students prefer textbooks over e-books for learning and this preference is not altered by familiarity with the medium".*

As noted above, this stage of the questionnaire discusses the experiences of the real users of the e-book. In this context, the research monographs and the course book represent the most used types of e-books (by MAS students). This result is supported again by Letchumanan and Tarmizi (2010). The results also confirm that most of the participants

used the e-book to look up answers to a particular question, for reading at leisure and finding materials for assignments. It seems that the student's use of the e-book for academic purposes is still weak. These results have been supported by many previous studies (Abdullah & Gibb, 2006; Noorhidawati & Gibb, 2008; Letchumanan & Tarmizi, 2010). Noorhidawati and Gibb (2008) conclude that finding materials for a project and looking up for the answer to a particular question, is the primary objectives of using the e-book. Moreover, Letchumanan and Tarmizi (2010) also report that 84.6% of respondents have selected that they use e-books to find materials for their assignments, while 61.5% confirmed that they use the e-book to do research. Reading pleasure and leisure is the most common reason for the adoption of the books by university students (Abdullah & Gibb, 2006).

The research results in subsection 5.2.3.5 also indicate that mobile devices occupy the first place in the list of the devices that are most commonly used to read the e-book. It is clear that the use of mobile devices for e-reading is growing rapidly, especially among young people, and the number of e-books to fill this e-reading is increasing in quantity and accessibility (Doiron, 2011). Mustafa *et al.* (2014, p. 124) confirm that *"Mobile technology has made e-books possible to those with mobile data connection for smartphone application"*. Likewise, the results obtained by Rhema (2013) support these findings where the claim that *"Mobile phone technology is promoted as a viable e-learning platform, especially at a time when the available internet infrastructure is limited and unreliable. This could provide new means for communication, open up accessible educational opportunities, and improve access to educational materials"*. Kissinger (2011) also stresses that there is an increasing use of mobile devices by students to read e-books.

Because e-books have already opened the door for a more interactive and deeper learning experience, most of the real users of the e-book have expressed their desire to use more of e-books in the future. Rhema (2013) confirms that Libyan students show a desire to use more modern technology in their education in the future.

## 6.2 Discussion of the Developed Model Results

The main objective of this research is to determine the factors that could have an effect on the acceptance of the e-book by MAS students at universities in Libya. In this research, the factors of the developed model have been classified into three groups and sixteen hypotheses. The hypotheses include the extrinsic factors, intrinsic factors and TAM constructs. This subsection answers the second research question that has been addressed in section 1.4. The second research question measures the factors that could affect the acceptance of the e-book by MAS students at universities in Libya. The subsections below discuss the relationships between the factors that represent the hypotheses of this research. Table 6.1 summarises the results of the model hypotheses.

**Table 6.1: The Summary of the Hypotheses Investigated in the Developed Model**

N	Developed Model Hypotheses			Hypothesis Result
H1	M	→	PU	Not supported
H2	AC	→	PU	Not supported
H3	F	→	PU	Not supported
H4	F	→	PEOU	Supported
H5	C	→	AU	Not supported
H6	LS	→	PEOU	Not supported
H7	TS	→	PEOU	Supported
H8	SI	→	AU	Supported
H9	LG	→	PEOU	Excluded
H10	SE	→	PEOU	Supported
H11	SE	→	AU	Supported
H12	RC	→	AU	Supported
H13	PEOU	→	PU	Supported
H14	PEOU	→	AU	Supported
H15	PU	→	AU	Supported
H16	AU	→	BI	Supported

N is Number of Hypotheses

### 6.2.1 The Hypotheses of External Factors (Extrinsic and Intrinsic Factors)

The main aim of this research is to investigate the factors that could have an effect on the acceptance of e-books amongst MAS students at universities in Libya. Ten external factors are identified and divided into two groups. The first group consists of seven factors. These factors are considered extrinsic factors, which are related to the infrastructure of universities, the characteristics of e-books and social factors such as Technical Service



Quality (TS), Library Service Quality (LS), Mobility (M), Accessibility (AC), Facilities (F), Cost (C) and Social Influence (SI). The second group is identified as intrinsic factors, which are related to users or potential users. These factors are Self-Efficacy (SE), Resistance to Change (RC), and Language (LG).

#### **6.2.1.1      *Mobility***

The results of this research show that the factor of mobility appears to have an insignificant direct effect on PEOU. The M factor has no effect on students' BI through PEOU and students' AU towards using the e-book. It could be due to the slow internet speed used in Libyan universities, especially since the average internet connection speed in Libya is 0.5 Mbps in 2014, amongst the slowest in the world (McIntyre, 2014). There are a large number of users who still rely on the dial-up connection to access the Internet. The most popular method to obtain e-books is to download the files from several e-book websites to be read by the computer or any e-reader devices, especially when there is a lack of university libraries, such as Libyan universities, that offer e-books. Therefore, the slow internet speed in the universities makes access to the e-book websites difficult. In most cases, the ability to take advantage of the features offered by mobile devices, such as the ability to access anytime and from anywhere, (24/7) fades when there is no suitable internet service provided at the universities. The research finding is supported by Phan and Daim (2011) and Noorhidawati and Gibb (2008). In contrast, the results obtained by Choi (2012); Peek (2012); Al-Ammary, Al-Sherooqi, and Al-Sherooqi (2014); Park, Sung, and Cho (2015) confirm that mobility plays an important role to encourage students to adopt e-books in their education.

#### **6.2.1.2      *Accessibility***

The AC factor is evaluated in this research; where there is no significant direct effect found with PU or indirect impact on students' AU and BI. Based on the research results obtained by Park *et al.* (2009) in developing countries, the significant relationships between accessibility and PU, AU and BI are inconsistent, because it depends on the level of availability of e-books in these countries. The availability of many e-books online for

free does not make up for the absence of e-books in the libraries of universities in Libya. Therefore, the factor of accessibility has lost its significance in influencing students' AU towards the adoption of the e-book. This result comes in line with Thong *et al.* (2002); Park (2009), where they confirm that AC is not significant towards PU.

#### **6.2.1.3 Facilities**

The result of this research also demonstrates that the F factor is the second significant factor that impacts on PEOU. Although F has no direct effect on PU, it has an indirect influence on PU through PEOU. It also has an indirect effect on students' AU and BI towards the adoption of the e-book. There are many functional features of the e-book, such as tools that assist in clarifying the contents of the e-book, i.e. citation creation, highlighting, bookmarking, note taking, searching, integration with multi-media, sound and animation, as well as annotating. These features can help students use e-books more efficiently and may enhance their perception towards the adoption of the e-book. Mustafa *et al.* (2014, p. 125) report that "*features offered by the e-book are very critical in ensuring the reading process continue to progress*". Maduku (2015c) also finds that F appears to have a significant impact on e-book acceptance. The same finding is supported by Shelburne (2009) and Anuradha and Usha (2006).

#### **6.2.1.1 Cost**

In this research, there is no substantial evidence that confirms the impact of cost on students' AU towards the use of the e-book. It could be due to the high level of income per capita in Libya, as compared to other developing countries (Ekanayake & Chatrna, 2010). Besides the free education provided by the government of Libya (Rhema, 2013), most public universities in Libya provide monthly grants for all students to help them buy the necessary tools to support their educational process (Education Audiovisual and Culture Executive Agency (EACEA), 2012). Therefore, students can buy electronic devices, such as laptops or desktop computers and buy e-books contents online easily. Most of the students also already have smartphones that can be used to read e-books (Rhema, 2013).

#### **6.2.1.2 Library Services Quality**

The research results have shown that the relationship between LS and PEOU is insignificant. In fact, the result is not surprising because most universities in Libya are still struggling to improve the quality of their services, especially those related to the provision of e-books. Therefore, the students rely on other sources, such as from the Internet (whether those offered for free or paid), to get e-books. This explains why the students ignore the importance of the electronic library service in the Libyan universities. Also, the lack of students' experience and knowledge about the importance of e-book services in the libraries of the universities can be a major cause as well. However, Roesnita and Zainab (2013) and Lamothe (2013) confirm the importance of the services provided by the academic libraries with regards to the use of e-books.

#### **6.2.1.3 Technical Service**

Based on the results of this research, TS has a positive impact on PEOU. Students are convinced that the availability of the necessary services, such as software and hardware, maintenance services, as well as the Internet encourages students to use the e-book. This result aligns with Abbad *et al.* (2009a) who stress the impact of TS on PEOU. According to Edward W. Walton (2013), the availability of technical services has increased the opportunity for easy access to e-books and digital resources on the web. The results of this research are also supported by Rhema (2013), who contends that technical service is one of the most important factors that affect the adoption of technology in the higher education sector in Libya.

#### **6.2.1.4 Social Influence**

. In this research, the statistic results confirm that SI has a significant influence on students' AU. It also indirectly impacts students' BI to use the e-book. This could be due to the active social culture in Libya. The nature of the Libyan students in general is that of being influenced by the surrounding community and complying with the terms of reference of the President, parents and teachers, or peers such as friends or colleagues. According to Turner (2005), the encouragement by officials, faculty members and librarians

at universities to use e-books will have a positive impact in attracting more students towards the utilisation of the e-book. Moreover, Jin (2014) points out that SI plays an important role as the core determinants of PEOU and PU. Numerous studies have supported the influence of SI on AU and BI (Yang & Chen, 2006; YANG, 2007; Jong & Wang, 2009; Park, 2009; Tarhini *et al.*, 2013; Elkaseh, Wong, & Fung, April 2015).

#### **6.2.1.5 Self-Efficacy**

The findings of the present research show that SE is the first strongest factor that influences PU of use of e-books. The findings also contend that SE has a positive effect on students' AU towards using e-books. It also has a high and indirect positive effect on the BI of using e-books through PEOU and students' AU. The findings can be explained by the user's confidence in their abilities to use e-books associated with their judgment on the PEOU of the devices that are used to download and read e-books. Thus, by developing students' skills in the use of computers or other devices that can be used to read e-books, it will have a positive impact in attracting more students towards the utilisation of e-books. Hsiao and Chen (2015) and Jin (2014) have reached the same results, where they confirm the importance of SE in the adoption of the e-book. Waheed et al. (2015) also support the findings of this research.

#### **6.2.1.6 Resistance to Change**

The results of this research indicate that RC has a negative impact on the acceptance of e-books among MAS students at universities in Libya, whether through a direct effect on students' AU or indirect impact on students' BI. RC can be the result of the difficulties faced by students when they use the e-book. Many obstacles prevent the use of e-books and generate a resistance (of the student) to change. For example, some of the problems are related to the student himself, such as not wanting to change his studying habits or lacking the harmony with the technology of the e-book. Also, it can be traced to not having a desire to change to some technical problems facing the students when using e-books. Similarly, Bhattacharjee & Hikmet (2007) hypothesise that users' RC has a negative

relationship with subsequent IT usage behaviours and the outcomes come to support this hypothesis.

#### **6.2.2 Hypotheses for the TAM Constructs**

Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Students' Attitude (AU) and Students' Behavioural Intention (BI) is the important constructs of the TAM model (Davis, 1989; Venkatesh & Davis, 2000; Venkatesh & Bala, 2008). PU, PEOU and students' AU also represent the mediator factors that link the external factors and students' BI. PU is defined as the degree to which student thinks that the use of e-books in education will have great benefits and provide positive outcomes, while PEOU refers to the degree to which student believes that the use of e-books will take less effort (Venkatesh & Davis, 2000). The term, 'Students' AU' represents the degree to which the student has formulated conscious plans to perform or not perform some specified future behaviour (Venkatesh & Davis, 2000), whereas students' BI refers to the positive or negative feeling on the adoption of the e-book (Venkatesh & Davis, 2000).

Based on the findings of this research regarding the impact of the PU factor upon the AU, the PU appears to have a strong direct effect on the students' AU. The PU also has an indirect impact on BI via students' AU. Students who benefit from e-books will significantly have a positive attitude towards using the e-book. The perception of how useful the e-book is on improving students' performance could be implying that students should be kept updated with the latest mathematical and statistics applications and software to use with the e-book, to ensure a positive attitude towards using the e-book. The results of the research are consistent with studies done by Letchumanan and Muniandy (2013). Letchumanan and Muniandy (2013) point out that PU is a major factor in affecting students' AU towards using the e-book.

Based on section 5.4, PEOU appears to have a strong impact on PU. The importance of PEOU is through a direct impact on students' AU regarding the use of the e-book. PEOU also has an indirect influence on students' BI through PU and students' AU. Numerous studies have confirmed that PEOU has a strong influence on the adoption of technological

products in general, such as e-books (Davis, 1989; Chang *et al.*, 2012; Letchumanan & Muniandy, 2013). PEOU explains the choice of the majority of the participants who use the e-book due to easy handling. Therefore, PEOU is considered an important determinant in enabling the e-book to be perceived as a useful learning resource by the non-users. These findings are also consistent with Letchumanan and Muniandy (2013).

In this research, PU is a more prominent factor in students' AU towards using e-books than PEOU. This is because students would prefer to use e-books if they have positive emotions about the usefulness of e-books in improving their understanding of Mathematics and Statistics, and thus, enhancing their effectiveness in learning. The results of this research match the results from a study on mathematics students' BI at Universiti Putra Malaysia (UPM) (Letchumanan & Muniandy, 2013). It is also supported by (Tao, 2008); Letchumanan and Tarmizi (2010). Students' AU seems to have a strong influence on students' BI. The positive feelings of the students towards the use of the e-book will be positively reflected in their behaviour. The result of the impact of students' AU towards BI is in line with Letchumanan and Tarmizi (2011). In summary, the results of the hypotheses of the TAM constructs correspond with previous studies (Lee, 2006; Park, 2009). This research confirms that the TAM is a useful theoretical model to understand and interpret students' BI to use the e-book, where all the TAM constructs appear to have a significant impact on the acceptance of e-books among MAS students at universities in Libya. For this reason, there is potential for practical application in the adoption of e-book among MAS students at Libyan universities.

### **6.3 The Role of the Extrinsic and Intrinsic Factors**

Although the current literature cannot conclude on the roles of intrinsic and extrinsic factors in the area of technology adoption (Yoo *et al.*, 2012), most of the literature reviewed in subsection 3.1.4 overestimate the impact of intrinsic factors in promoting e-books while ignoring the role of the extrinsic factors. Therefore, the third question of this research aims to determine the group that plays a significant role in the acceptance of e-books. The first group of factors represents the intrinsic factors relating to users' and non-

users' characteristics such as Resistance to Change (RC), Self-Efficacy (SE) and Language (LG). The second group of factors is the extrinsic factors and they include the factors related to e-book characteristics such as Accessibility (AC), Cost (C), Mobility (M) and Facilities (F) and the factors related to the infrastructure of universities, which are Technical Service Quality (TS) and Library Service Quality (LS) and the factor of social factor which is Social Influences (SI). They are operational in the model of this research via PU, PEOU, AU and BI.

The results obtained in section 5.4 confirmed that the intrinsic factors appear as the strongest indication of students' BI. SE and RC emerge as good predictors for students' BI; whether through direct or indirect impact via PU, PEOU and students' AU. However, extrinsic factors such as F should also be taken into account as a good predictor of students' BI. TS and SI have significant effects on the acceptance of e-books as well. Table 6.2 shows the order of the factors that have a strong impact on the acceptance of e-books in each group.

**Table 6.2: Effective Groups of Factors in the Model**

<b>Intrinsic Factors</b>	<b>Extrinsic Factors</b>
SE	F
RC	TS
	SI

Although there are only a few intrinsic factors that have been measured in this research, (i.e. SE, RC and LG), all the intrinsic factors' hypotheses have been accepted. All the intrinsic factors have also demonstrated their importance, except the language factor which has been removed during the data analysis process. The results reveal that the SE represents the strongest external factors that have been used. Yoo *et al.* (2012) also support the research results, and they confirmed that the intrinsic factors have more influence on students' BI than the extrinsic factors. According to Deci, Connell, and Ryan (1989); Williams *et al.* (1996); Black (2000); Baard, Deci, and Ryan (2004), the intrinsic factors

can help to improve the performance and satisfaction in the performance of many tasks in different areas as compared to the extrinsic factors.

Nevertheless, most of the studies about the acceptance of the e-book confirmed that extrinsic factors also play a role in the adoption of the e-book, especially in developing countries that are still experiencing problems in technology and infrastructure (Gulati, 2008). The results of this research also support this claim, where F, TS and SI are the most important extrinsic factors that affect the use of the e-book amongst MAS students. Wang, Wu, and Wang (2009) emphasised that the impact of extrinsic factors might disappear in the non-voluntary environments. They point out that the use of technology in non-voluntary environments does not predict users' BI towards the technology via the extrinsic factors. If the university insists upon students to use the e-book, the impact of extrinsic factors tends to be cancelled or diluent. In this case, the universities must provide the necessary infrastructure for the use of e-books such as the e-library, internet services, e-reader devices and technology services and support. Currently, Libyan universities are still unable to provide e-book services that will enable the student to use e-books easily. That is why; the universities in Libya do not impose on students the mandatory use of e-books. Thus, the impact of extrinsic factors on the acceptance of e-books among MAS students at universities in Libya is clear and effective. Therefore, despite the importance of intrinsic factors to adopt e-books among MAS students at universities in Libya, the role of extrinsic factors is also important and cannot be ignored.

#### **6.4 Developed Model Performance and Its Ability to Predict Students' BI**

The purpose of this section is to answer the fourth question that evaluates the performance of the developed model in this research and its ability to predict the changes in the behavioural intention of the adoption of e-book amongst MAS students in the future. Although there is a rich and fast-growing literature in the field of the e-book, the research that focuses on the acceptance of e-books is limited (Letchumanan & Tarmizi, 2011a; Jin, 2014). Moreover, there are only a few studies that measure the effect of extrinsic and intrinsic



factors on the acceptance of the e-book, especially in developing countries (Table 6.3). This research introduces three intrinsic factors and seven extrinsic factors to predict students' BI. The research hypotheses are tested to measure the relationships between these factors and the TAM constructs. The performance of the research model is examined by measuring its power to explain the variance by using the coefficient of determination ( $R^2$ ) for the dependent variables (BI, AU, PEOU, and PU).  $R^2$  is the most important measure that is used in the statistical analysis to assess the model's ability to explain and predict future results. It is also used as a guide to measure the accuracy of the model.

Based on the results obtained in section 5.5, the explanatory power of BI, AU, PEOU, and PU is 40%, 60%, 29% and 30% respectively. Although the ratios obtained from the developed model in this research are not very high, they are one of the highest percentages that have been achieved by any research studying the acceptance of e-books (See Table 6.3). In most research which aims to predict human behaviour, the value of  $R^2$  is often less than 50%, because it is difficult to predict human behaviour, which is completely different from physical processes.

**Table 6.3: Review of Studies on the Acceptance of the e-book Model**

Research	Country	Factors type				Factors Explained ( $R^2$ )			
		Intrinsic Factors	Effect Direction Towards	Extrinsic Factors	Effect Direction Towards	PU	PEOU	AU	BI
Letchumanan and Muniandy (2013)	Malaysia	-	-	-	-	None	.56	.69	0.25
Letchumanan and Tarmizi (2011a)	Malaysia	Gender Moderator	PU; PEOU	-	-	.32	None	.11	0.20
Ngafeeson and Sun (2015b)	USA	Subjective Norm (SN); Innovative-ness (TI) System Exposure (Moderator)	PU, PEOU, BI	-	-	*	*	*	*

Lee (2013)	South Korea	Perceived Risk; Innovation Resistance; Innovativeness	PU, PEOU, BI	-	-	*	*	*	*
Ngafeeson and Sun (2015a)	USA	SI; Gender Moderator	PU, PEOU  PU, PEOU	-	-	*	*	*	*
Tao (2008)	USA	-	-	Information Quality; System Quality	PEOU, PU	.36	.34	-	.11
This research	Libya	SI, SE, RC, Gender Moderator	PEOU, AU	AC, CM, F, TS, LS	PU, PEOU, AU	.30	.29	.60	.40

(-) = Not applicable, (\*) = Not provided

The process of predicting dependent variables is done by measuring the direct and indirect effects of independent variables and other dependent variables on the variable measured by the mediator factors. According to the results obtained in section 5.4 and 5.5, the factors of PEOU, PU, AU and students' BI represent the dependent variables. The final model obtained in section 5.5 has been translated to linear equations based on the multiple regression models. In the developed model, the factors of F, SE and TS represent the

important predictors of PEOU. The PEOU factor can explain 29% of the changes of students' PEOU towards e-books in the future. The statistical equation ( $PEOU = 0.22 F + 0.32 SE + 0.18 TS$ ) can be used to predict the factor of PEOU in the future. The coefficient of determination  $R^2$  is 0.29. All the factors used to estimate the PEOU are dependent variables. In addition, PU is also the dependent variable, predictable by the equation:  $PU = 0.11F + 0.15SE + 0.09TS$ . PEOU is the only dependent variable that can estimate the value of PU while F, SE, and TS are independent variables that can be used to estimate PU through the indirect relationships. The PU factor can explain 30% of the changes of students' PU in the future. The coefficient of determination  $R^2$  is 0.30. Also, Students' AU represents the dependent factor in the developed model that can explain about 60% of the changes of students' AU towards e-books in the future. PU and PEOU are good predictors to PU. In addition, SI and SE are the critical factors used to estimate the factor of AU. RC is the only factor that has a negative effect on the students' AU. After reducing the coefficient form for PEOU and PU, the linear equation that used to estimate students' AU is:  $AU = AU = 0.17F + 0.35SE + 0.10TS + 20SI - 0.13RC$ . The coefficient of determination  $R^2$  is 0.60. Finally, students' BI is also the dependent factor in the developed model. Students' AU is considered the strongest predicting factor to students' BI ( $BI = 0.53 AU$ ). The student's BI can be estimated through the direct effect of students' AU ( $BI = 0.53 AU$ ), while ( $BI = 0.10F + 0.20SE + 0.053TS + 0.11SI - 0.10RC$ ) explains the student's BI across the indirect effect of independent variables through the mediator variable (PU, PEOU, and AU). The coefficient of determination  $R^2$  is 0.40. In this research, the explanatory strength for students' BI in the future is 40%.

This statistical formula can be used by decision-makers and researchers in the field of e-books to predict the behaviour of MAS students at universities in Libya in the future. On the other hand, the results obtained can be generalised to other disciplines because it did not include any results related to the specialisation of MAS. Therefore, the statistical formula can be used to predict students' BI in higher education at universities in Libya generally. Also, it can be used in any environment that is similar to the environment of the research, such as some Arab countries.

## **6.5 The Moderating Effect of Gender**

One of the main research objectives is to investigate the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books among MAS students. This section provides an adequate answer to the fifth research question, which asks whether there is a difference between the genders regarding the acceptance of e-books. In achieving this objective, this section discusses the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books. Two models with sixteen hypothesis in each model have been tested to provide a better understanding of e-book acceptance between male and female students taking Mathematics and Statistics at Universities in Libya. Only one hypothesis is excluded for not meeting the terms of statistical analysis. Four hypotheses measured the impact of the TAM constructs, while eleven hypothesis has tested the effect of intrinsic and extrinsic factors in each model.

Subsection 6.5.1 discusses the effect of gender differences on the TAM constructs, while subsection 6.5.2 discusses the impact of gender differences in the extrinsic and intrinsic factors.

### **6.5.1 Gender Differences and TAM Constructs**

The findings in Table 6.4 show that gender does not moderate the relationship between PU, PEOU, AU and BI in most of the hypotheses. This is perhaps due to the convergence rate of the use of e-books among males and females, which reduces the expected differences between them (Wong, Teo, & Russo, 2012).

**Table 6.4: The Summary of the Moderating Effect on the TAM Constructs**

Hypothesis	Path			Male		Female	
				Standardised Coefficient		Standardised Coefficient	
				Direct effect	Indirect effect	Standardised Coefficient	Indirect effect
<b>H13</b>	PEOU	→	PU	0.44***	-	0.65***	-
<b>H14</b>	PEOU	→	AU	0.45***	0.18	0.16 (ns)	0.28
<b>H15</b>	PU	→	AU	0.48***	-	0.43***	-
<b>H16</b>	AU	→	BI	0.48***	-	0.59***	-

Note: \*\*\* = P-value ≤ 0.01, \*\* = P-value ≤ 0.05(-) = not applicable, ns = not significant

The TAM constructs are found to be positive and significant for most relationships. Although the results confirm that PEOU has a strong influence on females' PU more than the males, it insignificantly impacts on females' AU towards the acceptance of the e-book. However, it has a strong indirect influence on female students' AU through the PU factor. Tarhini, Hone, and Liu (2014, p. 177) explained that "*females tend to place more emphasis on ease of use of the system when deciding to whether or not adopt a system*". Therefore, they may be selecting e-books because they think it will reduce the effort required in their study, research and finding of solutions to their questions. It can also help them to understand their subjects since most of them have not used the e-book before and have no experience in dealing with it. Similarly, Ong and Lai (2006) confirm that the impact of PEOU on female students is more than males.

With regards to PU, the construct is slightly stronger for male students than females. The results of this research are supported by many kinds of literature such as by (Venkatesh & Morris, 2000; Yang & Chen, 2006; Al-Aulamie, 2013); Smeda, Shiratuddin, and Wong

(2017). Hoffman (1972); Venkatesh *et al.* (2003) explain that male students tend to concentrate more on the benefits that they will accrue from the use of technology and they are driven by achievement needs more than females. Sun and Zhang (2006) also emphasise that males are more influenced than females by the PU construct.

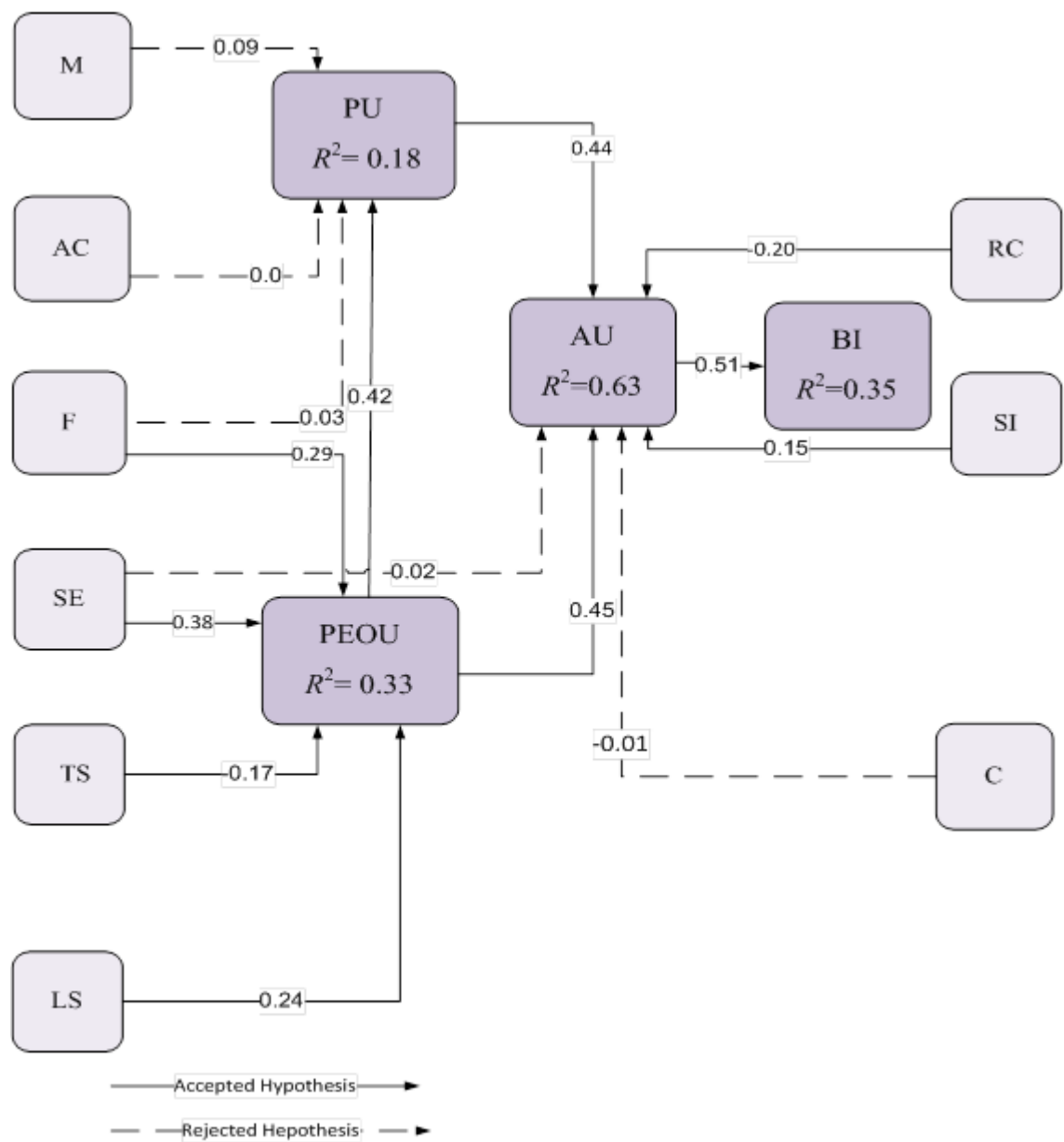
Students' BI is used to predict the extent of the acceptance of technology such as e-books (Davis, 1989). According to the results shown in Table 6.4, AU is a strong predictor of students' BI in both the male and female participants. Similarly, Fishbein and Ajzen (1975) have indicated that BI is predicted by using users' AU. It is logical to expect that the positive attitudes will produce positive behaviours, whether in the case of male or female students. However, the females' AU is always courageous, especially when it comes to technology, which in turn could contribute to their excellence.

Therefore, the TAM constructs are significant in most relationships in both models. However, the only difference observed is their ability to explain the variance in the developed model in this research, called R-squared ( $R^2$ ) or the coefficient of determination. The coefficient of determination is a measure commonly used in statistical analysis to assess the model's ability to explain and predict future results. It is also used as a guideline to measure the accuracy of the model. Based on the results mentioned in the males' model as shown in Figure 6.1, PEOU explains 18% of the variance in PU, while the factors of F, SE, TS, LS explains 33% of the variance in PEOU. The factors of SI, RC, PU and PEOU explain about 63% of the variance in males' AU towards using the e-book. The developed model for males can explain 40% of the variability in students' BI towards the usage of the e-book. According to the males' model shown in Figure 6.2, F and PEOU explain 55% of the variance in PU, while the factors of LS explains 25% of the variance in PEOU. The factors of SE, SI, RC, PU and PEOU explain about 56% of the variance in students' AU towards using the e-book. The structural model in this research can explain 44% of the variability in the BI of students toward the usage of the e-book. The results shown in Table 6.5 confirmed that the female model is more accurate and able to predict the behaviour of students in the future, in comparison to the male model. In fact, these results

are expected due to the high level of higher education enjoyed by women in Libya, as compared to the other developing countries (Tamtam *et al.*, 2011; Rhema, 2013).

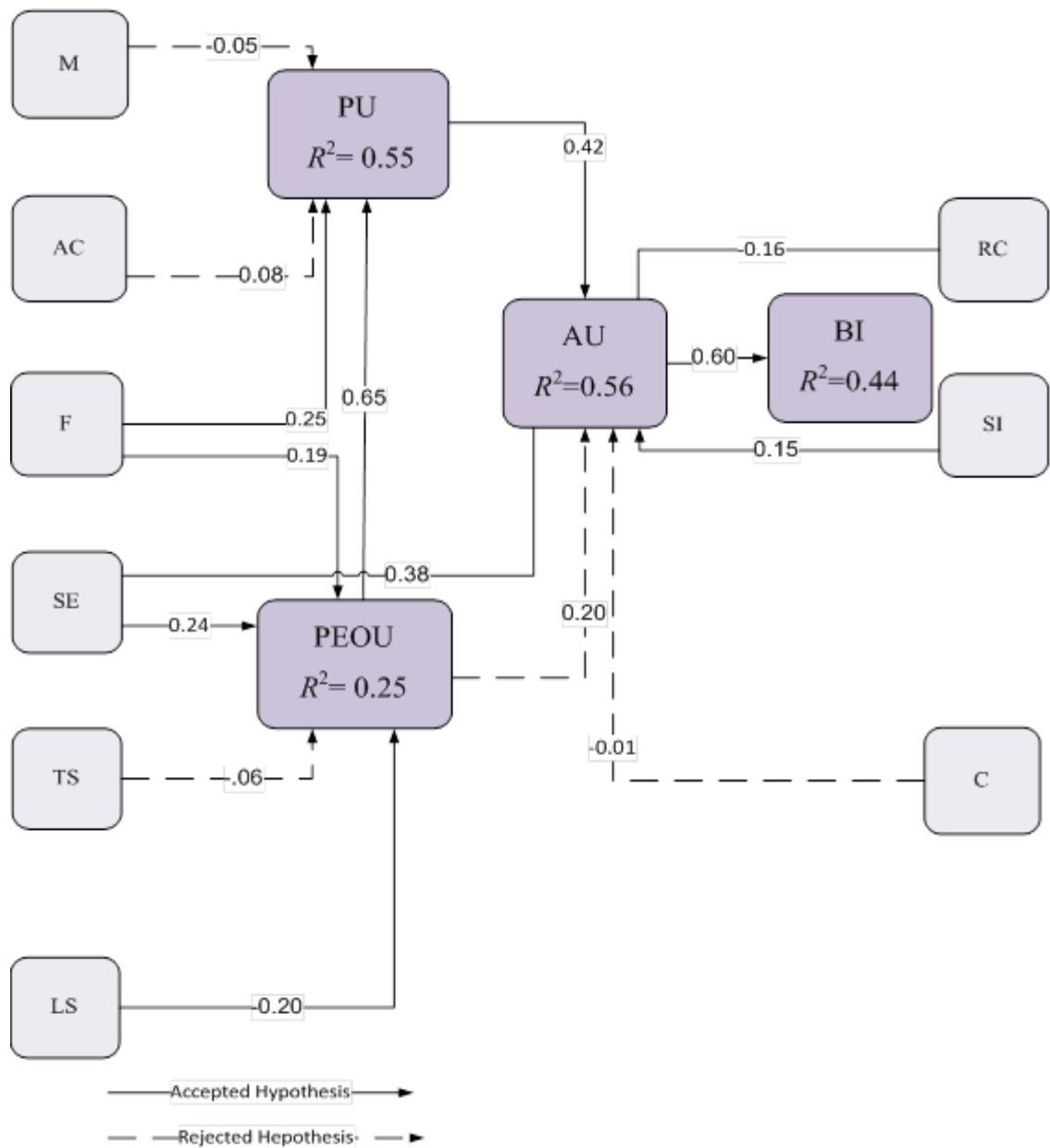
**Table 6.5: The Explained Variance for the Dependent Variables for Each Group**

<b>Gender</b>	<b>PU</b>	<b>PEOU</b>	<b>AU</b>	<b>BI</b>
<b>Male</b>	0.18	0.33	0.63	0.35
<b>Female</b>	0.55	0.25	0.56	0.44



**Figure 6.1: Results of the Developed Model for Males**





**Figure 6.2 : Results of the Developed Model for Females**

### 6.5.2 Gender Differences and the External Factors (Extrinsic and Intrinsic Factors)

Eleven hypotheses have been tested in this research. Eight hypotheses are similar in terms of impact, whereas three hypotheses have a significant difference in terms of the acceptance of the e-book being different between males and females (Table 6.6). Two

hypotheses belong to extrinsic factors, which are F and TS; and just one hypothesis represents the influence of the intrinsic factor, SE (Figures 6.1 and 6.2).

**Table 6.6: The Summary of the Moderating Effect on Research Hypotheses**

Hypothesis	Path			Male			Female		
				Standard- ised Coef- ficient	t-val- ues	p- valu e	Standard- ised Coef- ficient	t-val- ues	p- value
H1	M	→	PU	0.09	1.05	0.29	-0.05	-0.57	0.57
H2	AC	→	PU	0.000	0.03	0.97	0.08	1.09	0.28
<b>H3</b>	<b>F</b>	→	<b>PU</b>	<b>- 0.03</b>	<b>- 0.26</b>	<b>0.800</b>	<b>0.25</b>	<b>2.58</b>	<b>**</b>
H4	F	→	PEOU	0.29	3.28	***	0.18	1.99	*
H5	C	→	AU	-0.1	-1.29	0.200	-0.01	-0.11	0.91
H6	LS	→	PEOU	-0.24	-2.26	**	0.20	2.34	***
<b>H7</b>	<b>TS</b>	→	<b>PEOU</b>	<b>0.17</b>	<b>2.19</b>	<b>*</b>	<b>0.060</b>	<b>1.84</b>	<b>0.070</b>
H8	SI	→	AU	0.15	2.20	*	0.24	2.95	***
H10	SE	→	PEOU	0.38	4.07	***	0.24	2.15	**
<b>H11</b>	<b>SE</b>	→	<b>AU</b>	<b>0.02</b>	<b>0.30</b>	<b>0.770</b>	<b>0.30</b>	<b>3.38</b>	<b>***</b>
H12	RC	→	AU	-0.20	-2.65	**	-0.16	-1.98	**

**Note:** (\*\*\*= P-value ≤0.001, \*\*=p-value≤ 0.01\* = P-value ≤0.05, broad line= hypotheses that are significantly different between gender).

F towards PEOU seems to be statistically significant in both genders. In contrast, the relationship between the factor of F and PU is significant for female students and

insignificant in males. The results of this research show that female students use e-books more commonly for the interactive features such as highlighting and the feature of multimedia. Marston et al. (2014) support the research result, where they emphasise that female students make more extensive use of the interactive features of an e-textbook rather than their male counterparts.

The factor of TS shows a strong impact on PU in the case of male students. It may be due to the period spent by male students to study and use the facilities in the university. Male students are more likely to spend a long time in the computer lab, using the library service and internet service for different educational purposes compared to female students. Therefore, male students are more influenced by the level of services offered by the universities. The result obtained by Penny (2010) confirms that male students spend significantly longer time per week using the university's facilities for all purposes as compared to the female students.

SE has been found to be stronger for female students than males. The factor of SE has a strong influence on female students' AU, while it has an insignificant impact on the AU of male students towards the use of e-books. These results are consistent with the results obtained from other research (Morris & Venkatesh, 2000; Ong & Lai, 2006; Madigan *et al.*, 2007; Ngafeeson & Sun, 2015a). However, SE has a significant impact on PEOU in the case of males. Female students seem more confident than males when using the e-book. Morris and Venkatesh (2000); Tarhini *et al.* (2014) have interpreted that an increased level of SE will lead to the decline in the importance of ease of use. In fact, the number of female students in higher education in Libya exceeds the number of male students. This could explain the superiority of females in the use of technology (Abdulatif, 2011; Al-Hadad, 2015).

Moreover, although the hypothesis (H8) that represents the relationship between SI and students' AU towards the adoption of the e-book is accepted in both cases (male and female), the results confirm that female students are more influenced by the SI factor than males. These results are consistent with the results obtained from many types of research

(Venkatesh & Morris, 2000; He & Freeman, 2009; Wang *et al.*, 2009; Tarhini *et al.*, 2014).

The moderating impact of males and females on the acceptance of the e-book has received great attention, but most of the results obtained in this research are inconsistent (Ngafeeson, 2011; Al-Aulamie, 2013; Marston *et al.*, 2014). This could be due to the long war that has broken out in Libya since 2011. The war has had negative effects especially on the men, which has resulted in the absence of many males in education for a long time (Rhema & Miliszewska, 2012). As such, this may have affected the participants' responses, especially that of the male students.

## **6.6 Summary**

In this chapter, the research questions are discussed as first mentioned in Chapter One. The first section addresses the results that answered of the first question, which is “*What are the students’ knowledge and experience towards the usage of the e-book among MAS students at universities in Libya?*”. The results of descriptive statistics related to the students’ knowledge and experience on the use of the e-book were discussed in this section.

The second section of this chapter deals with a detailed explanation of the results that have been used to answer the second research question, which is “*What are the factors that could influence the acceptance of the e-book among MAS students at universities in Libya?*”. This section focuses on explaining the results of the fourteen factors that are tested by sixteen hypotheses. The hypotheses results are discussed to determine the direct and indirect impact of the factors on the acceptance of e-books among MAS students at universities in Libya.

The third section addresses the role of the intrinsic and extrinsic factors in the acceptance of the e-book. It also determines which group has a strong impact on students’ BI. This section discussed the results that answered question three “*What is the group of factors that play a significant role in the acceptance of the e-book among MAS students at universities in Libya (intrinsic or extrinsic group)?*”. All the intrinsic factors tested in this research have a significant impact on the acceptance of the e-book. SE is the first factor

that has a strong effect on students' BI in the intrinsic group. Seven external variables are subjected to examination in this research. However, only three variables play a great role in the acceptance of e-books among MAS students in Libya, namely F, TS and SI.

Next, the performance of the theoretical model and its ability to predict the changes in the students' BI in the adoption of the e-book is discussed as well. This section discussed the results that answered question four *“How does the performance of the developed model in this research and its ability to predict the changes in students' behavioural intention affect the adoption of the e-book amongst MAS students in the future”*.

This chapter also investigates the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books among MAS students. It provides a more thorough understanding of e-book acceptance between male and female students taking MAS at universities in Libya. This section also discussed the results that answered question five, which is *“Are there any significant differences in the acceptance of the e-book between the genders?”*

## **7 Chapter Seven: Conclusion**

### **7.0 Overview**

This concluding chapter provides a summary of the research objectives and results. It also includes the research contributions, limitations and recommendations for future researchers.

#### **1. To investigate the knowledge and experience of MAS students on the perception and adoption of the e-book at universities in Libya.**

This objective has been achieved through two sections of the survey questions, sections A and B (Appendix C). The first section addresses the demographic information, while the other section includes details regarding the current use of the e-book. SPSS (v 21) was used to analyse data and obtain results from the descriptive statistics. Based on the results of the survey, 65.4% of participants confirmed that they have knowledge about the e-book, while 34.6% answered “No” where they were asked if they knew anything about the e-book before the survey. Although the percentage level of students who confirmed their knowledge of the e-book was relatively good, the turnout with regards to the use of the e-book among students was poor. Nevertheless, the majority of real users (42.7%) rarely like to use the e-book, whereas just about 21.1% of the participants use it daily. Moreover, the majority of e-book users are unaware of the correct way to benefit from the e-book in academic fields such as in research, and its use is still limited to finding answers to some questions regarding certain topics or in leisure reading. Furthermore, smartphones and laptops were chosen to be the more popular devices used to read e-books. Overall, increasing the number of interested users who are keen on the use of e-books in Libya makes us more optimistic about the adoption of the e-book in the higher education sector in Libya in the future.

## **2. To investigate the factors affecting the acceptance of e-books amongst MAS students at universities in Libya.**

The Technology Acceptance Model (TAM) is used in this research to investigate the acceptance of the e-book among MAS students at universities in Libya. Ten external factors (M, AC, F, C, LS, TS, LG, SE, SI, RC) were selected based on previous lectures, so as to extend the TAM model. Fourteen factors were subjected to measurement against sixteen hypotheses in this research (M, AC, F, C, LS, TS, LG, SE, SI, RC, PEOU, PU, AU, and BI). The hypotheses represent the relationships between the factors of the research model. Based on the research results, the factor of language has been excluded due to statistical reasons. Therefore, the hypothesis related to the language factor was cancelled. Finally, ten hypotheses were accepted, while five hypotheses were rejected.

According to the results obtained by this research, the hypotheses of PU, PEOU, AU and students' BI were accepted. The TAM constructs seem to have a strong influence on the acceptance of the e-book among MAS students at universities in Libya. Five external factors hypotheses were accepted. The factors of SE, F, SI, TS and RC also appeared to have important effects on the acceptance of e-books among MAS students at universities in Libya, whereas the hypotheses of M, AC, LS and C factors were rejected.

## **3. To investigate which group of factors plays a significant role in the acceptance of the e-book among MAS students at universities in Libya (intrinsic or extrinsic factors).**

The research proposed fourteen factors to enhance the TAM to investigate the acceptance of e-books among MAS students at universities in Libya. The factors are divided into three groups, which are: the intrinsic factors (LG, SE, RC); the extrinsic factors (M, AC, F, C, LS, TS, SI) and the TAM constructs (PEOU, PU, AU, BI).

The intrinsic factors appeared to be the strongest indication of students' BI. SE and RC emerged as good predictors for students' BI; whether through direct or indirect impact via PU, PEOU and AU. However, extrinsic factors such as F should also be taken into account as an important factor which has an effect on the acceptance of the e-book. TS and SI have significant effects on the acceptance of the e-book as well.

SE was the strongest factor amongst the intrinsic factors, which indicates that SE can play a critical role in students' acceptance of the e-book. Moreover, the results further indicated that intrinsic factors play an important role in the acceptance of e-books after the TAM constructs.

**4. To develop the theoretical model to derive a mathematical relationship to predict the MAS students' behavioural intention to use the e-book at universities in Libya in the future.**

Path analysis was used to explain students' behavioural intention by using the AMOS software. The path diagram was translated to four statistical equations, as each statistical equation was designed to predict one of the dependent variables. The coefficient of determination ( $R^2$ ) represents the most important criteria that were used in the statistical analysis to assess the model's ability to explain and predict future results. The final statistical formulas obtained in this research to predict PU, PEOU, AU and students' BI are as follows:

$$\text{PEOU} = 0.22 F + 0.32 \text{SE} + 0.18 \text{TS} \dots \dots \dots (1)$$

$$R^2 = 0.29$$

In the developed model, the factor of PEOU represents the dependent variable. The factors of F, SE and TS represent the important predictors of PEOU. The PEOU factor can explain 29% of the changes of students' BI in the future.

$$\text{PU} = 0.11 F + 0.15 \text{SE} + 0.09 \text{TS} \dots \dots \dots (2)$$

$$R^2 = 0.30$$

PU is also a dependent factor. The only factor that has a direct effect on the PU is another dependent factor, PEOU. The independent factors (F, SE, and TS) can predict the PU through the mediator variable (PEOU). The PU factor can explain 30% of the changes of students' BI in the future.

$$\text{AU} = 0.17 F + 0.35 \text{SE} + 0.10 \text{TS} + 0.20 \text{SI} - 0.13 \text{RC} \dots \dots \dots (3)$$

$$R^2 = 0.60$$



Students' AU also represents the dependent factor in the developed model. PU and PEOU are good predictors of students' AU. F, SE, TS, SI and RC are the critical independent factors used to predict the factor of AU. RC is the only factor that has a negative effect on the students' AU. The students' AU could interpret 60% of the changes of students' BI in future. It is considered the strongest predicting factor of all.

$$BI=0.10F+0.20SE+0.053TS+0.11SI-0.10RC.....(4)$$

$$R^2 = 0.40$$

Students' BI is also the dependent factor in the developed model. Students' AU is considered the strongest predicting factor for students' BI. The independent variables (F, SE, TS, SI and RC) are used to predict the students' BI. In the developed model in this research, the explanatory strength for the students' BI in the future is 40%.

Due to the absence of certain results related to the students of MAS only, the results obtained in this research can be generalised to all students at universities in Libya. Although this study included only MAS students, the results obtained are not only linked to the specialisation of Mathematics and Statistics. Therefore, the results can be generalised to the rest of the disciplines. In general, the statistical equations can be used to predict higher education students' behaviour towards the adoption of the e-book in Libya.

##### **5. To investigate the moderating impacts of gender towards students' acceptance of the e-book. The research will explore if males and females have different perceptions towards the e-book.**

The impact of gender differences has become a source of concern for many researchers in the acceptance of the e-book (Maduku, 2015a). Nevertheless, only a few studies have focused on researching the effect of gender differences in the acceptance of the e-book in developing countries such as South Africa (Maduku, 2015a), while no studies have been conducted in Libya at all (Abdulatif, 2011; Al-Hadad, 2015). This research has investigated into the moderating impact of gender on the relationships among the factors affecting the acceptance of e-books among MAS students at universities in Libya. It also

provides a more in-depth understanding of e-book acceptance between male and female students taking MAS at universities in Libya.

The gender moderating effect was measured through a multi-group analysis using AMOS. The multi-group analysis involved the grouping of data on the gender lines and then performing a path analysis on each gender separately. The Figures 6.1 and 6.2 show the results of the male and female students from this analysis.

The terms of multi-group analysis of the measured variables, i.e. the questionnaire questions that have been used to measure the external factors, were perceived equally by both genders. It means that both male and female students understood the questionnaire in the same way. With regards to the model relationships, the multi-group analysis showed significant differences between the genders. Their differences were recorded for hypotheses H3, H7 and H11. Females' perception, according to the results, was mainly affected by SE and the level of F in descending order. On the other hand, the male students were affected by TS. The results indicated that female students are more receptive to e-books than their male counterparts. There are also clear differences in the ability of the models to explain the changes in students' BI. The results showed that the explained variance of female students' BI was larger than the males'.

## **7.1 Research Contributions**

This research offers the first step towards understanding MAS students' BI in the adoption of the e-book in developing countries in general and Libya in particular. The research contributions can be divided into two sections, theoretical contribution and practical contributions.

### **7.1.1 Theoretical Contribution**

1. The research utilised the TAM to explain the acceptance of MAS students at universities in Libya. This model accounts for both intrinsic and extrinsic factors in predicting and explaining the acceptance of the e-book among students. As a result, this model developed an explanation of the variance independent variables which are BI,

AU, PU and PEOU. The developed model is one of the qualified models, which discussed the use of the e-book and explained the behaviour changes of the students towards the adoption of the e-book in the future (Table 6.2).

2. This research confirms that the TAM is a useful theoretical model to understand and interpret students' BI to use the e-book, where all the TAM constructs appear to have a significant impact on the acceptance of e-books among MAS students at universities in Libya. For this reason, there is potential for practical application in the adoption of e-book among MAS students at Libyan universities
3. The research model was empirically validated by using Structural Equation Modeling (SEM) via AMOS, which provided for an adequate assessment of the developed model. The model was validated and examined through EFA, CFA and Path analysis. EFA was used to provide evidence of unidimensionality of the variables of each factor and check the validity of the factors proposed and compare the initial reliability of the variables by the test of internal consistency. The results obtained from the CFA confirmed the validity of the developed model through GOF, reliability and convergent validity. Moreover, path analysis that was used enabled the examination of the model in terms of variance and the hypotheses through Regression Weights for the parameters (estimate), Standard Error (SE), critical ratio and p-value. Path analysis was able to identify the effects of the external factors, therefore, explaining the variance in PU, PEOU, AU and BI.
4. The questionnaire was subjected to a thorough examination process in order to verify the validity and reliability of the questionnaire. The pilot test was used to develop the questionnaire and confirm the validity and credibility of the questions. Section 4.6 provides more details about the design and development of the questions. Therefore, it can be used in future studies.

### **3.1.1 Practical Contributions**

1. As mentioned in the first chapter of this research, the use of the modern instructional technology has triggered a boom in the area of teaching and learning in the higher education sector. It can promote, improve and change the traditional teaching

methods rely on printed sources and the use of electronic sources such as e-books, journals, and electronic research in higher education. For this reason, this research intends to investigate the factors that might hinder the adoption of the e-book among students at higher education institutions in Libya. To our knowledge, there is no research study so far which has examined the challenges facing e-book adoption in higher education in Libya. This research aims to study the factors that may hinder or encourage the adoption of the use of e-book in Libyan higher education. Therefore, this research has identified the factors that affect the use of the e-book among MAS students in Libya. Some factors have had a positive impact and encouraged students to use the e-book, such as the Facilities provided by the e-book (i.e. searching, downloading, taking notes, multimedia, etc.). Furthermore, the factor of SE that involving the students' confidence in their ability to use the devices used in reading e-books like the laptop, smartphones and e-readers devices represents a strong motivation to adopt the e-book. SI also played an important role to encourage students to adopt the e-book. Moreover, PEOU and PU had significant impacts to create a positive AU toward the acceptance of the e-book among MAS students. The findings of this research study indicated that most of the participating students in Libya have positive attitudes and the intention to the acceptance of the e-book. However, other factors played a negative impact on the acceptance of the e-book such as RC. The factor of RC represents barriers that have a significant role in non-proliferation of the use of e-books by students. Regarding the use of e-books among MAS students at universities in Libya, this research is a good source of information about the extent of the use of the e-book among MAS students at universities in Libya. It was found that the use of e-books is still in the early stage, where only a small group of students is using e-books within a narrow range.

2. Regarding the use of e-books among MAS students at universities in Libya, this research is a good source of information about the current extent of the use of the e-book among MAS students at universities in Libya. It was found that the use of e-books is still in the early stage, where only a small group of students is using e-books within a narrow range.

3. The research utilised multi-group analysis to test gender differences. Multi-group analysis is a statistic method using the difference in chi-square ( $\Delta\chi^2$ ) to compare between two groups or more. Multi-group analysis among the genders was conducted for the developed and measurement models. The perception of the measured variables and the research hypotheses by the different genders was assessed using path analysis. The multi-group analysis indicated that there was no difference between the genders in the perception of the measured variables. However, there was a difference in research hypotheses and the model was powerful in explaining the variance of male and female students' BI.
4. The obtained results can be generalised to other disciplines because it did not include any results related to the specialisation of Mathematics and Statistics.
5. The results of this research provided useful guidelines for the improvement and promotion of the acceptance of e-books in Libya, such as the definition of the factors that encourage and hinder the use of e-books among MAS students. On the other hand, it also considered a significant contribution to the existing body of literature on e-book acceptance, especially in developing countries.
6. The application of the developed model in explaining students' acceptance of e-books among MAS students at Libyan universities is the last contribution of this research. The developed model was successful in assessing the acceptance of e-books within the country. After proving the model's reliability and validity, the model was able to explain the relationship between the factors and students' BI.

## **7.1 Summary of the Research Results**

- 1) Although the level of students' knowledge and awareness of e-books has been relatively high, the usage of the e-book among MAS students is still in the early stages at universities in Libya.
- 2) Students' AU was the only factor that has a strong direct effect on students' BI.
- 3) PEOU, PU, SE, SI and F factors have significant indirect impacts on students' BI towards the adoption of the e-book.

- 4) TS and RC have a weak indirect effect on students' BI towards the adoption of the e-book.
- 5) The only factor that has a negative effect on students' AU is RC.
- 6) PEOU is significant upon PU and students' AU towards using the e-book.
- 7) PU has the strongest impact on students' AU, followed by PEOU.
- 8) SE is the strongest determiner of PEOU; whereas TS level has a positive impact on PEOU.
- 9) SI and RC are significant towards students' AU.
- 10) M, AC and F are insignificant towards PU.
- 11) LS is insignificant upon PEOU, and the C is insignificant towards students' AU.
- 12) Students' AU is a strong predictor that has a direct and strong impact on students' BI, while PEOU, PU, SI, SE, RC also have indirect effects on the model mediators. The estimated students' BI could be expressed by  $BI = 0.53 AU$ , the coefficient of determination  $R^2$  is 0.40 and the error of variance ( $1 - R^2$ ) is 0.60.
- 13) Despite the importance of intrinsic factors in the adoption of the e-book among MAS students at universities in Libya, the role of extrinsic factors is also important and cannot be ignored.
- 14) The explanatory power of BI, AU, PEOU, and PU was 40%, 60%, 29% and 30% respectively. The results obtained from this model are one of the highest that have been achieved by any other research (that studied the acceptance of the e-book).
- 15) The results showed that there are important differences between male and female students' perceptions in three of the hypotheses. The hypothesis of F towards PU and SE towards AU were supported in the females' case; however, they were rejected in the case of the male students. Moreover, TS towards PEOU was supported just in the males' case.
- 16) Females were more confident to use the e-book than males.
- 17) The females' model has greater ability to interpret variation as compared to the males' model.

## 7.2 Research Limitation

This research had interesting findings seeking to explain the acceptance of the e-book among MAS students, but there are certain limitations within the research. These included the following:

1. There is a possibility of flaws in the elements of the research like the design, data collection and even the interpretation of findings. This is because the data collected was undertaken immediately after an armed political conflict in Libya, which could have influenced the responses. Many questions within the research survey are related to the access, use and satisfaction with the technology by the participants and as the infrastructure was suffering from post-war destruction, this could also have affected the capacity for access to the ICT infrastructure; hence the responses could have some bias.
  2. It is also important to note that the findings of this research are based only on the study of MAS students in three Libyan universities. According to (Letchumanan & Tarmizi, 2010), MAS students are regarded as less progressive in e-book adoption than other student groups. Therefore, this may limit the ability to apply the results to other groups of students, especially if the results related to the students of MAS only (i.e. the lack of e-books in the field of Mathematics and Statistics).
  3. The outcomes of this research rely on the validity, accuracy, knowledge and perceptions of the participants who completed the survey. Also, the findings of the research are limited by the time during which the research was conducted.
- 18) The research could also be limited by the technology examined in the research. Caution should, therefore, be taken in the generalisation of these findings beyond the mentioned aspects. The research is limited to undergraduate students and should not be generalised to postgraduate students who are not a part of the participants included in this research.

### 7.3 Recommendations for Future Research

Based on the results obtained in this research, here are some recommendations to bear in mind for future research:

1. Future research within the field of the e-book needs to add other external factors such as information quality, system quality, perceived risk, innovation resistance and innovativeness that may improve the predictability and understanding of the factors that influence students' acceptance of the e-book at universities in Libya.
2. Future researchers should also pay more attention to the intrinsic factors in e-book research, where these factors appear to have a significant impact on e-book acceptance.
3. Moderating variables, such as language and student experience, should also be investigated since some of them have practical implications on the subject of the research. Most previous studies have focused on real users of the e-book. Therefore, researchers should investigate the moderating impact of experience on the relationships among the factors affecting the acceptance of the e-book. These studies may help provide a better understanding of the acceptance of e-books between real users and non-users of the e-book. Language is also an important factor that can be used as a moderator in the future.
4. Based on previous studies, the turnout of MAS students using the e-book is relatively low. Therefore, this research has focused on MAS students. Future research may include another discipline of higher education students in Libya.
5. This research is fundamentally based on a quantitative approach to a survey questionnaire that recognises the significance of locating the project within a particular cultural, social, and historical context. Qualitative research can also be used in the future to provide more detailed information that can support current research results. The qualitative approach is not only able to shed light on issues that may not be processed through the quantitative survey, but it will also help to highlight any unforeseen results of the quantitative study. Therefore, interviews with some students may also provide meaningful results.



6. Policymakers in Libya must work hard to develop the infrastructure of laboratories and libraries, as well as the internet services in Libyan universities because they constitute a significant obstacle to the adoption of the e-book by students. 99.4% of the participants in this research have demonstrated their willingness to use e-book, provided there were relevant opportunities and possibilities.

## Appendices

### Appendix A

#### The letter sent to AL-Jabal AL-Gharbi University for Invitation to participate and Informed Consent Questionnaire



#### Invitation to participate, Informed Consent Questionnaire and Interview

[www.murdoch.edu.au](http://www.murdoch.edu.au)

**Research Title: Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya**

**Date: / / 2014**

**Dear President of AL- Jabal AL-Gharbi University**

My supervisors, ~~Dr.~~ Mohd Fairuz Shiratuddin and associate professor ~~Dr.~~ Kevin Wong, and I are seeking your permission to conduct a research entitled as above at your institution as partial fulfilment of the requirements for a PhD in Information Technology at Murdoch University, Australia.

The main purpose of this research is to establish a framework to investigate the factors that affect the adoption of e-book among Mathematics and Statistics students at universities in Libya. This research will also determine the factors that stimulate or hinder on adoption of e-books through the study of the students and ~~teachers~~ perceptions and experiences relating to the use of e-book technology. Findings from this research can be used by future researchers since there are no previous researches that have been conducted in this field in Libya. Recommendations will be offered in this research that will facilitate decision making among academics in Libya, whereby they can establish strategies to incorporate the use of e-books in their educational institutions.

We are seeking your permission to recruit participants to take part in this research. After consent has been received from your institution, we will advertise on campus. Interested volunteers will be e-mailed with the questionnaire. They will also receive a sample of an e-book which is a part of the book of statistics and probability theory and practice. Included with this letter are the advertisement and information and consent letter.

Your cooperation is highly appreciated  
Sincerely

~~Asma Mohamead Smeda~~  
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Phone: + 61 (8) 9360-2794

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval ~~xxxx/xxx~~). If you have any reservation or complaint about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office (Tel. 08 9360 6677 (for overseas studies, +61 8 9360 6677) or e-mail [ethics@murdoch.edu.au](mailto:ethics@murdoch.edu.au)). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

CRICOS Provider Code: 00125J  
ABN 61 616 369 313

## The letter sent to Tripoli University for Invitation to participate and Informed Consent Questionnaire



### Invitation to participate, Informed Consent Questionnaire and Interview

[www.murdoch.edu.au](http://www.murdoch.edu.au)

#### Attachment A

**Research Title: Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya**

**Date: / / 2014**

**Dear President of Tripoli University**

My supervisors, Dr. Mohd Fairuz Shiratuddin and Associate Professor Dr. Kevin Wong, and I are seeking your permission to conduct a research entitled as above at your institution as partial fulfilment of the requirements for a PhD in Information Technology at Murdoch University, Australia.

The main purpose of this research is to establish a framework to investigate the factors that affect the adoption of e-book among Mathematics and Statistics students at universities in Libya. This research will also determine the factors that stimulate or hinder on adoption of e-books through the study of the students and teachers perceptions and experiences relating to the use of e-book technology. Findings from this research can be used by future researchers since there are no previous researches that have been conducted in this field in Libya. Recommendations THAT will be offered in this research will facilitate THE decision making PROCESS among academics in Libya, whereby they can establish strategies to incorporate the use of e-books in their educational institutions. |

We are seeking your permission to recruit participants to take part in this research. After consent has been received from your institution, we will advertise on campus. Interested volunteers will be e-mailed with the questionnaire. They will also receive a sample of an e-book which is a part of the book of "statistics and probability theory and practice". Included with this letter are the advertisement and information and consent letter.

Your cooperation is highly appreciated

Sincerely

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Phone: + 61 (8) 9360-2794

This study has been approved by the Murdoch University Human Research Ethics Committee (Approval xxxx/xxx). If you have any reservation or complaint about the ethical conduct of this research, and wish to talk with an independent person, you may contact Murdoch University's Research Ethics Office (Tel. 08 9360 6677 (for overseas studies, +61 8 9360 6677) or e-mail [ethics@murdoch.edu.au](mailto:ethics@murdoch.edu.au)). Any issues you raise will be treated in confidence and investigated fully, and you will be informed of the outcome.

CRICOS Provider Code: 00125J  
ABN 61 616 369 313

## The letter sent to AL-Zawia University for invitation to participate, Informed Consent Questionnaire and Interview



### Invitation to participate, Informed Consent Questionnaire and Interview

[www.murdoch.edu.au](http://www.murdoch.edu.au)

#### Attachment A

**Research Title: Investigation of the Perception and Adoption of e-book amongst  
Mathematics and Statistics Students at Universities in Libya**

**Date: / / 2014**

**Dear President of Al-Zawia University**

My supervisors, Dr. Mohd Fairuz Shiratuddin and associate professor Dr. Kevin Wong, and I are seeking your permission to conduct a research entitled as above at your institution as partial fulfilment of the requirements for a PhD in Information Technology at Murdoch University, Australia.

The main purpose of this research is to establish a framework to investigate the factors that affect the adoption of e-book among Mathematics and Statistics students at universities in Libya. This research will also determine the factors that stimulate or hinder on adoption of e-books through the study of the students and teachers perceptions and experiences relating to the use of e-book technology. Findings from this research can be used by future researchers since there are no previous researches that have been conducted in this field in Libya. Recommendations will be offered in this research that will facilitate decision making among academics in Libya, whereby they can establish strategies to incorporate the use of e-books in their educational institutions.

We are seeking your permission to recruit participants to take part in this research. After consent has been received from your institution, we will advertise on campus. Interested volunteers will be e-mailed with the questionnaire. They will also receive a sample of an e-book which is a part of the book of statistics and probability theory and practice. Included with this letter are the advertisement and information and consent letter.

Your cooperation is highly appreciated

Sincerely

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CRICOS Provider Code: 00125J  
ABN 61 616 369 313

## Appendix B

### Information and Consent Letter



[www.murdoch.edu.au](http://www.murdoch.edu.au)

#### Information and Consent Letter

##### Attachment E

##### Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya

##### Dear participant:

We invite you to participate in this research entitled "Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya" This research is part of my PhD study supervised by Dr. Mohd Fairuz Shiratuddin and Associate Professor Dr. Kevin Wong at Murdoch University, Australia.

##### Nature and Purpose of the Study

This research seeks to fill this gap by developing a framework to investigate the factors that affect the adoption of e-book among Mathematics and Statistics students at universities in Libya.

This research will also identify the factors that attract or hamper the acceptance of e-books by students and teachers in the Department of Mathematics and Statistics at universities in Libya. This research will also derive a mathematical relationship to predict the perception of the Mathematics and Statistics students in the future.

If you consent to take part in this research, it is important that you understand the purpose of it and the tasks you will be asked to complete. Please make sure that you ask any question you may have, and that all your questions have been answered to your satisfaction before you agree to participate.

##### What the Research will involve?

If you decide to participate in this research, you will be asked to participate to complete the questionnaire which is divided into four sections:

- Section A: Demographic data.
- Section B: Currently use of e-book.
- Section C: The acceptance of e-book.
- Section D: The factors related with users or potential users.
- Section E: The factors related with infrastructure of universities.
- Section F: The factors related with e-book characteristics.

It is estimated that answering the questionnaire will take approximately 30 minutes. The Interviews should take around 30 minutes as well.

##### Voluntary Participation and Withdrawal from the Research

Your participation in this research is entirely voluntary. You may withdraw without discrimination or prejudice. All information is treated as confidential and no name or other detail that might identify you will be used in any publication arising from the research. If you withdraw, you can dispose all the materials that are given to you without returning to us. If you complete the questionnaire and return it, you will have consented to participate in this research. After the questionnaire has been returned, no withdrawal is possible as we are not able to identify your returned questionnaire as there is no identity being kept. There is no online questionnaire and only paper based survey is available.

CRICOS Provider Code: 00125J

ABN 61 616 369 313

## Information and Consent Letter

### Privacy

Your privacy is very important, whether you elect to participate or not, all information will be kept entirely confidential. The administration of this institution which are associated with you in other role will not know whether you have elected to participate and will view only anonymous data. It will not be possible for them to identify you; neither will you be identified in any publication arising out of this study.

### Benefits of the Study

It is possible that there may be no direct benefit to you from participating in this research. However, the knowledge gained from the participation may help to identify the factors that motivate adoption of e-book among Mathematical and Statistical teachers and students at universities in Libya. Therefore, it will serve as a key information source for academics, decision makers as well as the administrators concerned with general implementation of e-learning in Libya. The findings of this research can also guide other higher education institutions in to adopt e-book.

### Possible Risks

There are no specific risks anticipated with participation in this research. The participants will be informed and confirmed with their right to confidentiality, anonymity and privacy. All information will remain anonymous during the course of writing the thesis.

If you have any questions about this project please feel free to contact either myself, Mrs. Asma Smeda at +92 5678 786/ +92 372 3032 or my supervisors, Dr. Mohd Fairuz Shiratuddin at +61 (8) 9360-2794 and Associate Professor Dr. Kevin Wong at +61 (8) 9360-6100. My supervisors and I will be happy to discuss with you any concerns that you may have about this research.

If you are willing to participate in this research, please complete and return the material in the self-addressed stamped envelope provided. If you are not willing to participate you can dispose all materials.

Thank you for your assistance with this research.

Sincerely

Asma Mohamad Smeda  
Doctoral Candidate  
School of Engineering and Information  
Technology  
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90 South Street, Murdoch  
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## Appendix C1

### Questionnaire in English



[www.murdoch.edu.au](http://www.murdoch.edu.au)

#### **An Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at universities in Libya**

##### **Attachment C**

Dear Student,

During recent years, new information technologies are causing institutions of higher education to explore ways in which these technologies can be effectively integrated in teaching and learning. One of these technologies is electronic-book (e-book).

There are three basic components of the expression 'electronic-book' as used within the modern day context. The first component revolves around the use of word, texts, numbers and diagrams; content that is in digital format cannot be read without using electronic devices such as a computer or a tablet. The second component is the software through which the e-book content is loaded and operated; for example, something as simple as a text files application, such as the Notepad on the computer. Third, the word e-book itself which is an electronic copy of the traditional books.

I am a PhD student at Murdoch University, Australia. I am currently conducting a survey as a part of my dissertation research to investigate the factors that influence student adoption of e-book in Mathematics and Statistics Students at universities in Libya. The survey questionnaire is divided into six sections: (A) Demographics, (B) Current use of e-book, (C) The Acceptance of e-book, (D) The factors related with users or potential users, (E) The factors related with infrastructure of universities and (F) The factors related with e-book characteristics.

I would greatly appreciate your participation in this survey. Your contribution is valuable since the empirical data from this research will be useful to university planners and other decision makers who are responsible for setting up, evaluating, or implementing e-learning in the country of Libya.

This survey will take approximately 30 minutes to complete. Taking the survey is entirely voluntary. Data from the questionnaire is for academic research purpose only. Data will be reported in aggregate form and your responses will be anonymous. Your consent to participate in this research is implied if you proceed with completing the survey. If you need a summary report of this study, please contact me at: [32256299@student.murdoch.edu.au](mailto:32256299@student.murdoch.edu.au)

Your time and effort for completing this survey is greatly appreciated.

Thank you

Sincerely,

Asma Mohamead Smeda

Doctoral Candidate

School of Engineering and Information Technology

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Phone: + 61 (4) 2409 9197

### **Section A: Demographics**

This section of the questionnaire explains some demographics and background information about you.  
Please tick one answer only.

1. What is the name of your university?  
☐ Tripoli University  
☐ Al-Jabal Al-Gharbi University  
☐ Al- Zawia University
2. What is your gender?  
☐ Male  
☐ Female
3. Before this survey, do you know anything about e-book?  
☐ Yes  
☐ No
4. Have you ever used e-book before?  
☐ Yes (please proceed to section B)  
☐ No (please proceed to section C)

### **Section B: Current use of e-book**

This section reflects the extent of your use of e-book and the target of use.

1. On average, how often do you use e-book? (please tick one answer only)  
☐ Daily  
☐ Weekly  
☐ Monthly  
☐ Less often
2. How would you describe your familiarity with e-book? (please tick one answer only)  
☐ Very familiar  
☐ Somewhat familiar  
☐ Familiar  
☐ Not very familiar  
☐ Very unfamiliar



3. For what purpose do you usually use e-book? (please tick all that applies)
- ☐ Finding material
- ☐ Look up answer
- ☐ Leisure reading
- ☐ Training
- ☐ Other (please specify) \_\_\_\_\_
4. What type of e-books have you used so far? (please tick all that applies)
- ☐ Textbook
- ☐ Course book
- ☐ Research Monographs
- ☐ Other (please specify) \_\_\_\_\_
5. Which of the following device(s) are you currently using? (Please tick all that applies)
- ☐ Desktop computer
- ☐ Smart phone
- ☐ Laptop
- ☐ Tablet
- ☐ e-book readers (i.e. Kindle Paperwhite)
- ☐ Other (please specify) \_\_\_\_\_
6. Would you like to use more e-book in future?
- ☐ Yes
- ☐ No

### Section C: The Acceptance of e-book

This section reflects the extent of your beliefs that e-book IS easy to use and IT will enhance your knowledge and learning performance.

**Instructions:** Please indicate your answer to each of the following statements by **circling** the number that represents your level of agreement or disagreement with it. Make sure that you respond to every statement and circle only one answer for each statement.

- **Perceived Usefulness of e-book in Learning**

The degree to which you think that the use of e-book in education will have great benefits and provide positive outcomes.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	Using e-book would probably improve my learning performance	1	2	3	4	5
2.	Using e-book would probably allow me to access to more materials	1	2	3	4	5
3.	Using e-book would probably save me time and money	1	2	3	4	5
4.	Using e-book would probably allow me to learn anytime and anywhere	1	2	3	4	5
5.	Overall, I find the e-book useful in my study	1	2	3	4	5

- **Easy to use e-book**

The degree to which you think that the use of e-book will take less effort.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
6.	I think easy for me to become skilful at using the e-book.	1	2	3	4	5
7.	I think getting information from e-book is easy for me.	1	2	3	4	5
8.	I think find e-book flexible to be interacting with.	1	2	3	4	5
9.	Overall, I think the e-book is easy to use.	1	2	3	4	5

- **Attitude towards e-book**

Positive or negative feelings about the use of e-book.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
10.	I feel confident using e-book.	1	2	3	4	5
11.	I feel that e-book gives me the opportunity to acquire new knowledge	1	2	3	4	5
12.	I feel uncomfortable when using e-book	1	2	3	4	5
13.	I feel that e-book increases the quality of learning because it integrates all forms of media (audio, video)	1	2	3	4	5
14.	I feel that I would be more interested in to study courses that use e-book	1	2	3	4	5

- **Behavioral Intention to use e-book**

The degree to which you have formulated conscious plans to perform or not perform some specified future behavior.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
15.	I intend to use e-book when the service becomes widely available	1	2	3	4	5
16.	I intend to use e-book regardless of the price	1	2	3	4	5
17.	I intend to use e-book if my university supports it	1	2	3	4	5
18.	Whenever possible, I intend to use e-book	1	2	3	4	5

### Section D: The factors related with users or potential users

This section is dedicated to understanding the issues that have a direct relationship with the individual behaviour of the user and the ability to use technology. This behaviour reflects the desire for change and the extent influenced by the behaviour of other people.

**Instructions:** Please indicate your answer to each of the following statements by **circling** the number that represents your level of agreement or disagreement with it. Make sure that you respond to every statement and circle only one answer for each statement.

- **Social Influence**

To what extent are you influenced by the behaviour of others.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	I will use e-book if the service is widely used by people in my community	1	2	3	4	5
2.	I will use e-book if my supervisors / seniors recommend it	1	2	3	4	5
3.	I will use e-book if the majority of my family members / relatives are using it	1	2	3	4	5
4.	I will use e-book if the majority of my friends are using it	1	2	3	4	5

- **Resistance to change**

The reasons why not to use e-book.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.	E-books are too difficult to read	1	2	3	4	5
6.	E-books are not available in subject areas relevant to my program	1	2	3	4	5
7.	My instructor requested that I do not use e-books	1	2	3	4	5
8.	I do not have access to a computer and/or Internet	1	2	3	4	5
9.	I do not trust e-books. They are not a reliable source	1	2	3	4	5
10.	I do not know where to find e-books	1	2	3	4	5
11.	E-books are too difficult to access remotely	1	2	3	4	5
12.	Overall, I am not familiar with e-book	1	2	3	4	5

- **E-reader devices self-efficacy**

Is the degree to which an individual beliefs that he or she has the ability to perform specific task/job using e-book.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13.	I am able to use e-book software with less support and assistant	1	2	3	4	5
14.	I am confident that I can overcome any obstacles when using e-book reader	1	2	3	4	5
15.	I am confident that I have adequate ability to use computer to buy and download e-book	1	2	3	4	5
16.	In general, I am sure that I can use E-reader devices to use e-book	1	2	3	4	5

- **Language**

The level of English language used in education.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
17.	My English language proficiency is very good	1	2	3	4	5
18.	My textbooks and course books are using the English Language	1	2	3	4	5
19.	English Language skills are very important to my education	1	2	3	4	5
20.	English is a main Language used in my class	1	2	3	4	5
21.	My teachers use the English Language in Lectures	1	2	3	4	5

### **Section E: The factors related to the infrastructure of universities**

This refers to a range of services provided e-book for students and teachers by universities.

**Instructions:** Please indicate your answer to each of the following statements by **circling** the number that represents your level of agreement or disagreement with it. Make sure that you respond to every statement and circle only one answer for each statement.

- **Technical Service**

The level of the necessary Information and communication Technology (ICT) provided by university to support education process.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	The quality of the Internet access in the university is very high	1	2	3	4	5
2.	The availability of computer labs and computer services in general is no bad	1	2	3	4	5
3.	The quality of wireless networking used is very poor	1	2	3	4	5
4.	The overall infrastructure of ICT available at the university somewhat acceptable	1	2	3	4	5

- **Library Services**

The services quality that provided by library to students and teachers.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.	The library provides e-books service	1	2	3	4	5
6.	E-books are easy to access in library	1	2	3	4	5
7.	The library does not offers e-books related with my subject	1	2	3	4	5



### **Section F: The factors related with e-book characteristics**

This section refers to some advantages and disadvantages of e-book.

**Instructions:** Please indicate your answer to each of the following statements by **circling** the number that represents your level of agreement or disagreement with it. Make sure that you respond to every statement and circle only one answer for each statement.

- **Accessibility**

Accessibility is the degree to which e-book is available to as many students and teachers as possible. Also, it can be viewed as the "ability to access" and benefit from some services.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1.	E-books available online	1	2	3	4	5
2.	E-books available in university library	1	2	3	4	5
3.	E-book available 24x7	1	2	3	4	5

- **Cost**

The cost is the amount of money paid by the student in order to buy an e-book. This cost includes electronic reading devices such as handheld devices, software used and electronic publications.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
5.	The costs of using e-book are reasonable	1	2	3	4	5
6.	The costs of e-book devices are very expensive	1	2	3	4	5
7.	E-book is available in university free of charge	1	2	3	4	5

- **Mobility**

This means that the advantages and disadvantages of mobile devices that are used for e-book reading.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
8.	Using mobile devices would probably help me to use e-book anywhere and anytime	1	2	3	4	5
9.	Using mobile devices would offer increased access to learning material	1	2	3	4	5
10.	Using mobile devices will harm my eyes	1	2	3	4	5

- **Facilities**

Is the utilization of the contents of the e-book (information and tools that help to clarify information) in the study of statistics and mathematics.

Item	Statement	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
13.	Permanent update of the information that would allow access to the latest studies and books in the field of mathematics and statistics	1	2	3	4	5
14.	Better quality of diagrams and display tables and graphs	1	2	3	4	5
15.	Multimedia capabilities help to explain many mathematics and statistics matters	1	2	3	4	5
16.	Ease of linking with any statistical program, such as Excel, SPSS and MATLAB	1	2	3	4	5



## Appendix C2

### Questionnaire in Arabic



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#### البحث في إمكانية اعتماد الكتاب الإلكتروني بين طلبة الرياضيات والإحصاء في الجامعات في ليبيا

عزيزي الطالب :

تكنولوجيا المعلومات ظهرت خلال السنوات الأخيرة و دفعت بالكثير من مؤسسات التعليم العالي للبحث في هذه التكنولوجيات الجديدة واستخدامها في تطوير التعليم. ومن أهم هذا التكنولوجيات المستخدمة هي الكتاب الإلكتروني.

تعرف كلمة ( الكتاب الإلكتروني) في العصر الحديث على انها تتكون من ثلاثة مكونات أساسية. المكون الأول هو عبارة عن النصوص و الأرقام و الرسوم البيئية , أي عبارة عن المحتويات والتي تكون في شكل رقمي لا يمكن قراءتها دون استخدام الأجهزة الإلكترونية مثل الكمبيوتر المكتبي أو أي نوع من أجهزة القراءة الإلكترونية. المكون الثاني هو البرنامج الذي يتم من خلاله تحميل محتويات الكتاب الإلكتروني وتشغيلها , على سبيل المثال تطبيق الملفات النصية مثل المفكرة على الكمبيوتر. المحتوى الثالث , الكتاب الإلكتروني نفسه و هو النسخة الإلكترونية من الكتاب التقليدية.

أنا طالب دكتوراه في جامعة مردوخ ، أستراليا. أنا حاليا اجري استبيان كجزء من رسالة بحثي لنيل درجة الدكتوراه وذلك للتحقيق في العوامل التي تؤثر على اعتماد الكتاب الإلكتروني بين طلبة الرياضيات والإحصاء في الجامعات في ليبيا. وينقسم الاستبيان إلى ستة أقسام : ( أ ) التركيبة السكانية ، ( ب ) الاستخدام الحالي للكتاب الإلكتروني ( ت ) و قبول الكتاب الإلكتروني ، ( ث ) و العوامل ذات الصلة مع المستخدمين أو المستخدمين المحتملين ، ( ج ) و العوامل ذات الصلة مع البنية التحتية للجامعات ( ح ) و العوامل ذات الصلة بخصائص الكتاب الإلكتروني. لمساعدتك في معرفة المزيد عن الكتاب الإلكتروني قبل البدء في هذا الاستبيان، قد صممت الباحثة نموذج بسيط لكتاب إلكتروني وهو عبارة عن وضع ورقات من الفصل الخامس من كتاب الإحصاءات والاحتمالات بين النظرية والتطبيق للنكتور علي العجيلي.

سأقدر لكم كثيرا مشاركتكم في هذا الاستبيان. مساهمتك هي ذات قيمة لكون البيانات التجريبية من هذا البحث ستكون مفيدة لمخططي الجامعة و غيرهم من صناع القرار المسؤولين عن إعداد وتقييم وتنفيذ التعليم الإلكتروني في ليبيا.

هذه الدراسة سوف تأخذ ما يقرب من 30 دقيقة لاستكمالها . المشاركة في الاستبيان هي طوعيه تماما . البيانات المتحصل عليها في هذا الاستبيان هي لغرض البحث العلمي فقط والبيانات سوف تكون سرية و ردونكم ستكون مجهولة المصدر. استمرارك فيما في استكمال هذا المسح هو موافقتك ضمنا على المشاركة في هذا البحث. إذا كنت في حاجة الى تقرير موجز عن هذه الدراسة ، يرجى الاتصال بالباحثة على العنوان التالي:

أقدر لكم مشاركتكم في هذا الاستبيان

مع خالص التقدير،

أسماء محمد صميده

مرشحة لنيل درجة الدكتوراه

CRICOS Provider Code: 00125J

ABN 61 616 369 313

القسم ( أ ) : الخصائص السكانية

هذا القسم من الاستبيان يوضح بعض العوامل الديموغرافية و معلومات أساسية عن المشترك . يرجى اختيار إجابة واحدة فقط.

1. ما هو اسم جامعتك ؟

☐ جامعة طرابلس

☐ جامعة الزاوية

☐ جامعة الجبل الغربي

2. ما هو جنسك ؟

☐ ذكر

☐ أنثى

3. هل تعرف شيئا عن الكتاب الإلكتروني قبل هذه الدراسة ؟

☐ نعم

☐ لا

4. هل سبق لك أن استخدمت الكتاب الإلكتروني من قبل؟

☐ نعم ( يرجى الانتقال إلى القسم ب)

☐ لا ( يرجى الانتقال إلى القسم ت )

القسم (ب): الاستعمال الحالي للكتاب الإلكتروني

يعكس هذا القسم مدى استخدامك للكتاب الإلكتروني و الهدف من هذا الاستخدام.

1. في المتوسط كم مرة تستخدم الكتاب الإلكتروني ؟ ( يرجى اختيار إجابة واحدة فقط)

☐ يوميا

☐ أسبوعيا

☐ شهريا

☐ أقل بكثير من الأحيان

2. كيف تصف معرفتك بالكتاب الإلكتروني ؟ ( يرجى اختيار إجابة واحدة فقط)

☐ مألوف جدا

☐ مألوف إلى حد ما

☐ مألوف

☐ ليس مألوف كثيرا

☐ غير مألوف

3. لاي غرض عادة تستخدم الكتاب الإلكتروني ؟ ( يمكنك اختيار العديد من الاجابات )

☐ ايجاد موضوع معين

☐ البحث عن أجويه

☐ القراءة من اجل الترفيه

☐ التدريب

☐ أي اجابات أخرى ( يرجى التحديد) \_\_\_\_\_

4. ما هو نوع الكتب الإلكترونية التي استخدمتها حتى الآن (يمكنك اختيار العديد من الاجابات)

☐ الكتب المدرسي

☐ الكتب المقرر من قبل الاستاذ في الفصل الدراسي

☐ دراسات متخصصة بالبحوث

☐ أي اجابات أخرى ( يرجى التحديد) \_\_\_\_\_

5. أي من الأجهزة التالية تستخدمه حاليا ؟ (يمكنك اختيار العديد من الاجابات)

☐ الكمبيوتر المكتبي

☐ الهواتف الذكية

☐ الحواسيب المحموله

☐ أجهزة قراءة الكتاب الإلكتروني مثل كندل ببيروايت

☐ أي اجابات أخرى (يرجى التحديد)

6. هل ترغب في استخدام أكثر الكتب الإلكترونية في المستقبل؟

☐ نعم

☐ لا

القسم (ت): قبول الكتب الإلكتروني

هذا القسم يعكس مدى إيمانك بأن الكتب الإلكترونية سهل الاستخدام وأن تكنولوجيا المعلومات سوف تعزز معلوماتك وقدرتك على التعليم.

تعليمات : يرجى تحديد ردودكم على كل من العبارات التالية بوضع دائرة حول الرقم الذي يمثل مستوى الاتفاق أو الاختلاف مع هذه العبارة. تأكد من أن الرد على كل عبارة يشار إليه بدائرة واحدة فقط حول الرقم الذي تختاره

- الفائدة الملحوظة من استخدام الكتب الإلكتروني
- هي الدرجة التي تعتقد فيها أن استخدام الكتب الإلكتروني في التعليم سيكون له فوائد كبيرة ويقدم لك نتائج إيجابية .

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
1.	استعمال الكتب الإلكتروني يحسن من مستوى التعليمي	1	2	3	4	5
2.	استعمال الكتب الإلكتروني يسمح لي بالحصول على المزيد من المراجع	1	2	3	4	5
3.	استعمال الكتب الإلكتروني يوفر لي الوقت والمال	1	2	3	4	5
4.	استعمال الكتب الإلكتروني سيسمح لي بالتعلم في أي وقت وأي مكان	1	2	3	4	5
5.	على العموم أجد الكتب الإلكتروني مفيدا في دراستي	1	2	3	4	5

- سهولة استعمال الكتب الإلكتروني

هي درجة اعتقادك بأن استخدام الكتب الإلكتروني سيأخذ منك أقل جهد

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
6.	أعتقد انه من السهل بالنسبة لي أن أصبح ماهرا في استخدام الكتب الإلكتروني	1	2	3	4	5
7.	أعتقد من السهل بالنسبة لي الحصول على معلومات من الكتب الإلكتروني	1	2	3	4	5

5	4	3	2	1	أعتقد أن الكتاب الإلكتروني مرن وسهل التكيف معه	8.
5	4	3	2	1	عموماً، أعتقد أن الكتاب الإلكتروني سهل الاستخدام	9.

- **موقفك من الكتاب الإلكتروني**
- هي عبارة عن المشاعر الإيجابية أو السلبية المتولدة لديك نتيجة استخدام الكتاب الإلكتروني

الرقم	العبارة	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
10.	أشعر بثقة عند استخدامي الكتاب الإلكتروني	1	2	3	4	5
11.	أشعر بأن الكتاب الإلكتروني يتيح لي الفرصة لاكتساب معرف جديدة	1	2	3	4	5
12.	أشعر بعدم الارتياح عند استخدام الكتاب الإلكتروني	1	2	3	4	5
13.	أشعر بأن الكتاب الإلكتروني يزيد من جودة التعليم لأنه يجمع جميع أشكال وسائل الإعلام ( الصوت والفيديو )	1	2	3	4	5
14.	أشعر بأنني سأكون أكثر اهتماماً بمناهج الدراسة التي تستخدم الكتاب الإلكتروني	1	2	3	4	5

- **النية السلوكية لاستخدام الكتاب الإلكتروني**
- هي درجة التخطيط لأداء أو عدم أداء سلوك محدد في المستقبل

الرقم	العبارة	لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
15.	أنوي استخدام الكتاب الإلكتروني عندما تصبح الخدمة متوفرة على نطاق واسع	1	2	3	4	5
16.	أنوي استخدام الكتاب الإلكتروني بغض النظر عن السعر	1	2	3	4	5
17.	أنوي استخدام الكتاب الإلكتروني إذا كنت جامعتي تدعم هذه الخدمة	1	2	3	4	5
18.	كلما كان ذلك ممكناً ، أعزم استخدام الكتاب الإلكتروني	1	2	3	4	5

### القسم(ث) : عوامل ذات الصلة مع المستخدمين أو المستخدمين المحتملين

صمم هذا القسم لفهم القضايا التي لها علاقة مباشرة مع السلوك الفردي للمستخدم و القدرة على استخدام التكنولوجيا. ويعكس هذا السلوك الرغبة في التغيير ومدى تأثير سلوك الفرد بالآخرين.

تعليمات : يرجى تحديد ردودكم على كل من العبارات التالية بوضع دائرة حول الرقم الذي يمثل مستوى الاتفاق أو الاختلاف مع هذه العبارة. تأكد من أن الرد على كل عبارة يشار اليه بدائرة واحدة فقط حول الرقم الذي تختاره

#### • التأثير الاجتماعي

الى أي مدى أنت تتأثر بسلوك الآخرين

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
1.	انا سوف استخدم الكتاب الإلكتروني إذا تم استخدامه على نطاق واسع من قبل الناس في مجتمعي	1	2	3	4	5
2.	انا سوف استخدم الكتاب الإلكتروني إذا أوصى به المشرفين على دراستي	1	2	3	4	5
3.	انا سوف استخدم الكتاب الإلكتروني إذا كان غالبية عائلتي و أقرابي يستخدمونه	1	2	3	4	5
4.	انا سوف استعمل الكتاب الإلكتروني إذا كان معظم أصدقائي يستخدمونه	1	2	3	4	5

#### • مقاومة التغيير

وهي الأسباب الرئيسية المسؤولة عن عدم رغبتك في استخدام الكتاب الإلكتروني

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
5.	الكتب الإلكترونية هي صعبة جدا في القراءة	1	2	3	4	5
6.	الكتب الكترونية غير متوفرة في التخصص الذي أدرسه	1	2	3	4	5
7.	أستاذي طلب مني عدم استخدام الكتب الإلكترونية	1	2	3	4	5
8.	ليس لدي جهاز كمبيوتر و أو شبكة انترنت	1	2	3	4	5
9.	انا لا أثق بالكتب الإلكترونية , فهي ليست مصدرا موثوقا للمعلومات	1	2	3	4	5
10.	انا لا أعرف كيف أجد الكتب الإلكترونية	1	2	3	4	5
11.	الوصول للكتب الإلكترونية عن بعد(استخدام الاجهزة الاسلكية والجهزة القذالة) صعب جدا	1	2	3	4	5
12.	انا غير متعود على استخدام الكتب الإلكترونية	1	2	3	4	5



- القدرة والكفاءة الذاتية على استخدام أجهزة القراءة الإلكترونية
- هو درجة إيمان الفرد بأنه يملك القدرة الكافية على أداء واجباته و أعماله باستخدام الكتاب الإلكتروني.

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
1.	أنا قادر على استخدام برمجيات الكتاب الإلكتروني مع أقل دعم ومساعدة	1	2	3	4	5
2.	أنا واثق من أنني أستطيع التغلب على أي عقبات عند استخدام قارئ الكتاب الإلكتروني	1	2	3	4	5
3.	أنا واثق أن لدي القدرة الكافية على استخدام الكمبيوتر لشراء وتحميل الكتاب الإلكتروني	1	2	3	4	5
4.	عموماً ، أنا واثق من أنه يمكنني استخدام أجهزة القراءة الإلكترونية لاستخدام الكتاب الإلكتروني	1	2	3	4	5

#### • اللغة

هي مستوى اللغة الانجليزية المستخدم في التعليم

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
17.	أنا اتقن اللغة الإنجليزية	1	2	3	4	5
18.	الكتب المدرسية و الكتب الدراسية بصفه عامة تستخدم اللغة الإنجليزية	1	2	3	4	5
19.	اللغة الإنجليزية مهمة جدا لدراستي	1	2	3	4	5
20.	اللغة الإنجليزية هي اللغة الرئيسية المستخدمة داخل حجرات الدراسة	1	2	3	4	5
21.	أستقنتي يستخدمون اللغة الإنجليزية في المحاضرات	1	2	3	4	5

**القسم (ج) : العوامل المتعلقة بالبنية التحتية للجامعات**

هذا القسم يشير إلى خدمات الكتاب الإلكتروني التي تقدمها الجامعات للطلاب والمعلمين

**تعليمات :** يرجى تحديد ردودكم على كل من العبارات التالية بوضع دائرة حول الرقم الذي يمثل مستوى الاتفاق أو الاختلاف مع هذه العبارة. تأكد من أن الرد على كل عبارة يشار إليه بدائرة واحدة فقط حول الرقم الذي تختاره.

• **الدعم الفني**

هو مستوى تقنية المعلومات والاتصالات الضرورية ( ICT ) التي تقدمها الجامعة لدعم العملية التعليمية

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
1.	مستوى الوصول إلى الإنترنت في الجامعة جيد جدا	1	2	3	4	5
2.	توافر مختبرات الكمبيوتر و خدمات الكمبيوتر بشكل عام في الجامعة ليس سيئا	1	2	3	4	5
3.	نوعية الشبكات اللاسلكية المستخدمة هي سيئة للغاية	1	2	3	4	5
4.	في العموم البنية التحتية لتكنولوجيا المعلومات والاتصالات المتاحة في الجامعة مقبولة إلى حد ما	1	2	3	4	5

• **خدمات المكتبة**

هي نوعية الخدمات التي تقدمها المكتبة للطلاب والمعلمين

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
5.	توفر خدمة الكتب الإلكترونية في المكتبة	1	2	3	4	5
6.	سهولة الوصول للكتب الإلكترونية في المكتبة	1	2	3	4	5
7.	المكتبة لا تقدم خدمات الكتب الإلكترونية ذات الصلة بموضوع دراستي	1	2	3	4	5



القسم (ح): العوامل ذات الصلة مع خصائص الكتاب الإلكتروني

تعليمات : يرجى تحديد ردودكم على كل من العبارات التالية بوضع دائرة حول الرقم الذي يمثل مستوى من الاتفاق أو الاختلاف معها. تأكد من أن الرد على كل تصريح و دائرة إجابة واحدة فقط لكل بيان

● إمكانية الوصول

هي الدرجة التي يكون فيها الكتاب الإلكتروني متاح لأكثر عدد من الطلاب والمعلمين. أيضا ، يمكن أن ينظر إليها على أنها " القدرة على الوصول إلى " والاستفادة من بعض الخدمات.

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
1.	الكتب الكترونية متاحة على شبكة الإنترنت	1	2	3	4	5
2.	الكتب الإلكترونية متوفرة في مكتبة الجامعة	1	2	3	4	5
3.	الكتب الإلكترونية متاحة 24x7	1	2	3	4	5

● التكاليف

التكلفة هو قيمة مالية الذي سيدفعها الطالب من أجل شراء الكتب الإلكترونية. وتشمل هذه التكلفة أجهزة القراءة الإلكترونية مثل الأجهزة المحمولة، والبرمجيات المستخدمة و المنشورات الإلكترونية.

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
4.	تكاليف استخدام الكتب الإلكترونية معقولة	1	2	3	4	5
5.	تكاليف أجهزة الكتب الإلكترونية عالية جدا	1	2	3	4	5
6.	الكتب الإلكترونية متاحة في الجامعات مجانا	1	2	3	4	5

● قابلية التنقل

وهذا يعني أن مزايا وعيوب الأجهزة النقالة المستخدمة لقراءة الكتب الإلكترونية.

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
7.	استخدام الأجهزة النقالة سوف يساعدني على استخدام الكتب الإلكترونية في أي مكان وزمان	1	2	3	4	5
8.	استخدام الأجهزة النقالة يتيح لي الحصول على الكتب الإلكترونية بشكل أكبر	1	2	3	4	5
9.	استخدام الأجهزة النقالة يضر بعيني	1	2	3	4	5

• **ق فارملا**

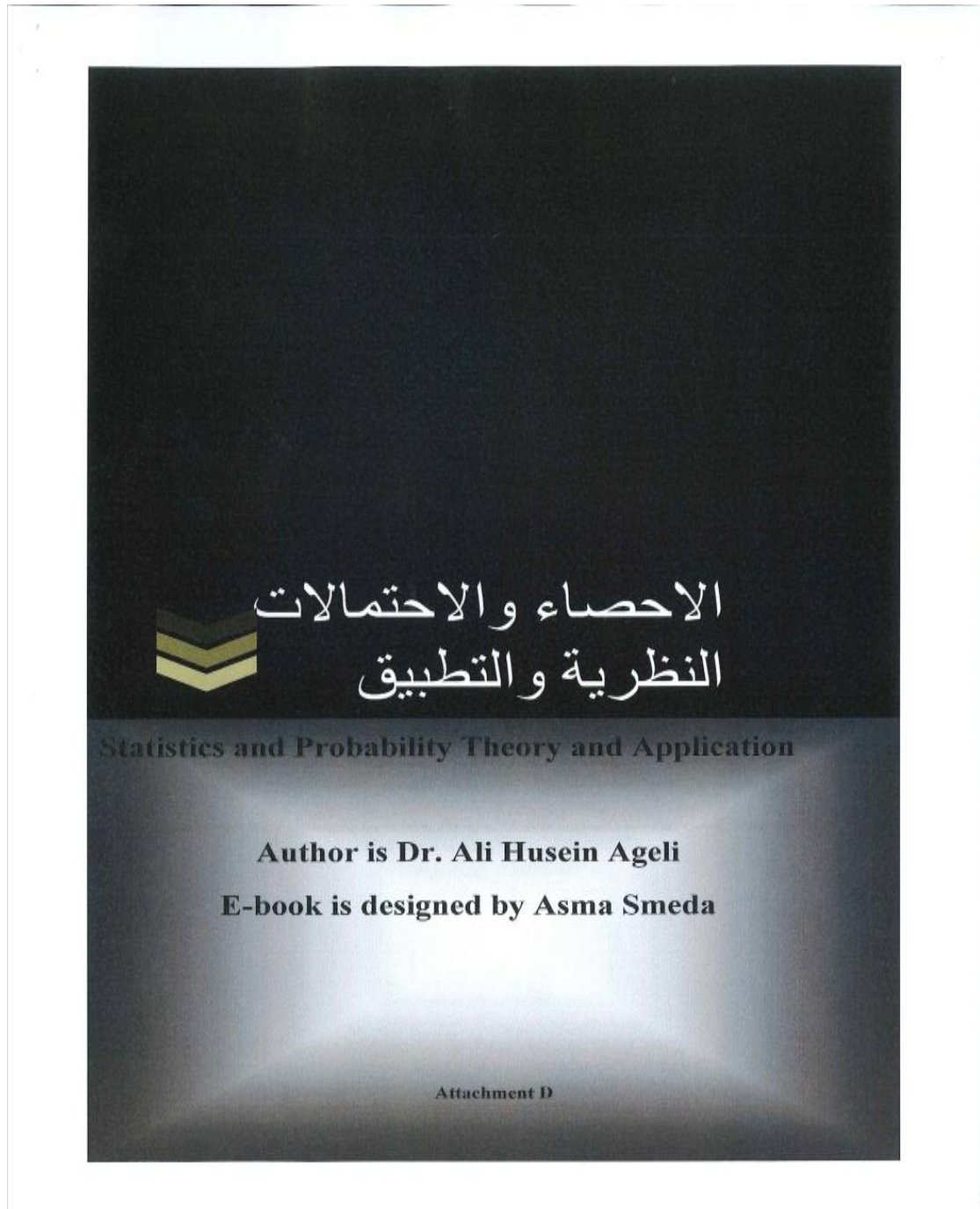
هو الاستفادة من محتويات الكتاب الإلكتروني (الأدوات التي تساعد على توضيح المعلومات ) في دراسة الإحصاء والرياضيات .

الرقم	العبارة	لا اوافق بشدة	لا اوافق	محايد	اوافق	اوافق بشدة
10.	التحديث الدائم للمعلومات من شأنها أن يسمح بالوصول إلى أحدث الدراسات والكتب في مجال الرياضيات والإحصاء	1	2	3	4	5
11.	العرض الجيد للجدول و الرسوم البيانية	1	2	3	4	5
12.	الوسائط المتعددة تساعد على شرح و توضيح الكثير من المسائل في الرياضيات والإحصاء	1	2	3	4	5
13.	سهولة الربط بين الكتاب الإلكتروني و أي برامج إحصائية أو رياضية أخرى ، مثل MATLAB و SPSS ،Excel	1	2	3	4	5

أنتهى الاستبيان

## Appendix D

The sample e-book used in this research (Arabic)



### توزيع بواسون (The Poisson Distribution)

إن هذا التوزيع يكون نموذجاً احتمالياً لكثير من الظواهر العشوائية النادرة الوقوع ، فهو يستخدم في المسائل التي تتعلق بحدوث الظواهر في فترات زمنية محددة حيث قد تكون الفترة الزمنية ثنائية أو دقيقة أو يوماً أو أسبوعاً أو شهراً ... الخ، كما يستخدم في المسائل التي تتعلق بحدوث الظواهر في مناطق محددة، حيث المنطقة المحددة قد تكون صفحة من كتاب أو متراً مربعاً من مساحة... الخ، ومن الأمثلة على ذلك : عدد المكالمات الهاتفية التي تتلقاها بدالة كلية العلوم خلال فترة زمنية محددة ، عدد حوادث السيارات التي تحدث في طريق معين خلال يوم من أيام الأسبوع ، عدد الأهداف التي تسجل خلال مباراة في كرة السلة، عدد مرات حدوث البرق أثناء عاصفة رعدية ، عدد الأشخاص الذين يدخلون مكتب البريد كل ساعة، عدد الأخطاء المطبعية في كتاب يحوي على العديد من الصفحات ، عدد البكتيريا في الخلايا ، عدد الجسيمات التي تنبعث من مادة مشعة خلال فترة زمنية محددة... الخ. أي أن هذا التوزيع يستخدم في وصف سلوك الأحداث النادرة بمعنى الأحداث التي تكون فيها فرصة نجاح الحدث صغيرة جداً.

يقال أن للمتغير العشوائي  $X$  توزيع بواسون بمعلمة  $\lambda$  ( $\lambda > 0$ ) إذا كانت له دالة الكتلة الاحتمالية التالية:

$$P(X = x) = \begin{cases} \frac{e^{-\lambda}}{x!} & , x = 0, 1, 2, \dots \\ 0 & , \text{خلاف ذلك} \end{cases}$$

ويرمز لذلك بالرمز  $X \sim P(\lambda)$  .

ومن الواضح أن  $P(X = x) \geq 0$  ويمكن إثبات أن  $\sum_{x=0}^{\infty} P(X = x) = 1$  . باستخدام المعطومة الرياضية التالية:

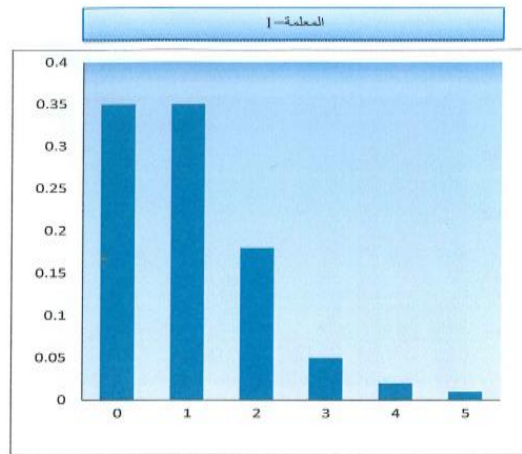
$$\sum_{x=0}^{\infty} \frac{a^x}{x!} = e^a$$

حيث  $a$  عدد حقيقي وعليه فإن:

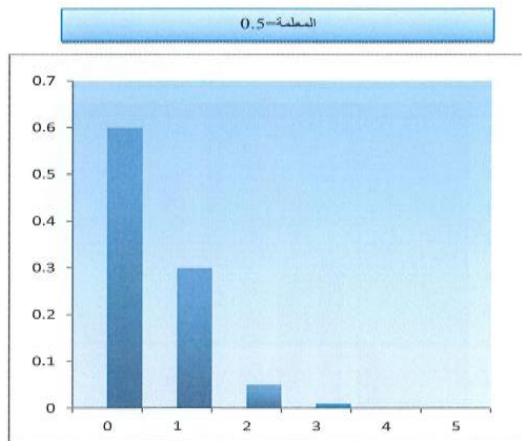
$$\sum_{x=0}^{\infty} P(X = x) = \sum_{x=0}^{\infty} \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=0}^{\infty} \frac{\lambda^x}{x!} = e^{-\lambda} e^{\lambda} = 1$$

والشكل (7) يوضح التمثيل البياني لدالة كتلة لاحتمال  $P(X = x)$  . ويتضح من ذلك أن هذا التوزيع ملئو إلى جهة اليمين

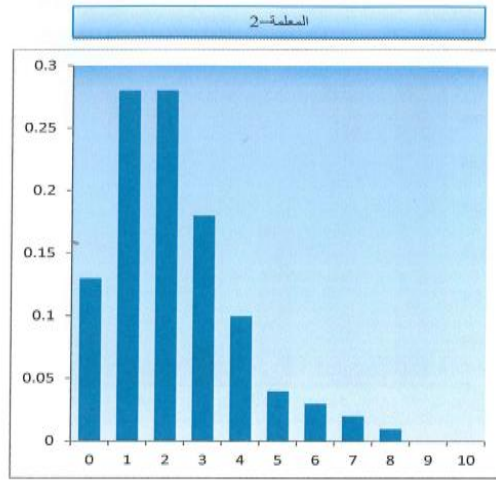
عندما تكون  $\lambda$  صغيرة ، وهذا يتماشى مع طبيعة المتغير العشوائي  $X$  وذلك لأن احتمال فشله كبير واحتمال نجاحه صغير.



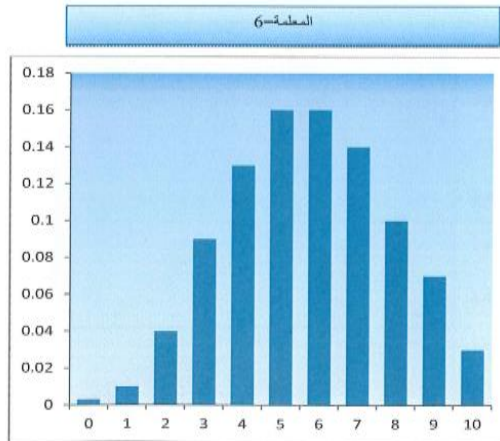
شكل (1-7) : دالة كثافة الاحتمال لتوزيع بواسون  $\lambda=0$



شكل (2-7) : دالة كثافة الاحتمال لتوزيع بواسون عند  $\lambda=0.5$



شكل (3-7) : دالة كثافة الاحتمال لتوزيع بواسون عند  $\lambda=2$



شكل (7) : دالة كثافة الاحتمال لتوزيع بواسون عند  $\lambda=6$

نظرية (8): إذا كان المتغير العشوائي  $X$  يتوزع وفق توزيع بواسون بمعلمة  $\lambda$  فإن:

$$\mu_X = E(X) = \lambda$$

$$\sigma_X^2 = V(X) = \lambda$$

$$m_X(t) = e^{\lambda(e^t - 1)}$$

البرهان : من تعريف القيمة المتوقعة نجد أن:

$$\begin{aligned} E(X) &= \sum_{x=0}^{\infty} x \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=1}^{\infty} \frac{\lambda \lambda^{x-1}}{(x-1)!} \\ &= \lambda e^{-\lambda} \sum_{y=0}^{\infty} \frac{\lambda^y}{y!}, \quad y = x - 1 \\ &= \lambda e^{-\lambda} e^{\lambda} = \lambda \end{aligned}$$

إن

$$\mu_{X=E(X)=\lambda} \dots \dots \dots (34)$$

و إن

$$\begin{aligned} E[X(X-1)] &= \sum_{x=0}^{\infty} x(x-1) \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=2}^{\infty} \frac{x(x-1) \lambda^x}{x!} \\ &= e^{-\lambda} \lambda^2 \sum_{x=2}^{\infty} \frac{\lambda^{x-2}}{(x-2)!} = e^{-\lambda} \lambda^2 \sum_{y=0}^{\infty} \frac{\lambda^y}{y!}, \quad y = x - 2 \\ &= e^{-\lambda} \lambda^2 e^{\lambda} = \lambda^2 \end{aligned}$$

وعليه فإن

$$E(X^2) = E[X(X-1)] + E(X) = \lambda^2 + \lambda$$

ومنها نجد أن

$$\sigma_X^2 = V(X) = E(X^2) - [E(X)]^2 = \lambda^2 + \lambda - \lambda^2 = \lambda \quad (35)$$

ومن تعريف الدالة المولدة للعزوم يتضح أن:

$$\begin{aligned} M_X(t) &= E(e^{tX}) = \sum_{x=0}^{\infty} e^{tx} \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=0}^{\infty} \frac{(\lambda e^t)^x}{x!} = e^{-\lambda} e^{\lambda e^t} \\ &= e^{\lambda(e^t - 1)} = \exp(\lambda(e^t - 1)) \dots \dots \dots (36) \end{aligned}$$

مثال(16): إذا علمت أن عدد حوادث السيارات التي تحدث في الاسبوع بمدينة معينة تتبع توزيع بواسن بمتوسط يساوي 0.7 فما احتمال وقوع ثلاثة حوادث على الأقل خلال الاسبوع؟

الحل:

إذا كان المتغير العشوائي  $X$

يتوزع وفق توزيع بواسون بمعلمة 0.7 فإن  $X$  يمثل عدد حوادث السيارات التي تحدث في الاسبوع وعليه فإن:

$$\begin{aligned} P(X \geq 3) &= \sum_{x=3}^{\infty} \frac{e^{-0.7}(0.7)^x}{X!} \\ &= 1 - P(X < 3) = 1 - P(X \leq 2) \\ &= 1 - \sum_{x=0}^2 \frac{e^{-0.7}(0.7)^x}{X!} \\ &= 1 - [0.4966 + 0.3476 + 0.1217] = 1 - 0.9659 = 0.0341 \end{aligned}$$

الحظ أنه بالإمكان الحصول على هذا الاحتمال باستخدام جدول احتمالات توزيع بواسون في آخر هذا الكتاب (جدول رقم(3))، فعندما  $\lambda = 0.7$  نجد أن:

$$\begin{aligned} P(X \geq 3) &= 1 - P(X < 3) \\ &= 1 - [P(X = 0) + P(X = 1) + P(X = 2)] \\ &= 1 - [0.4966 + 0.3476 + 0.1217] = 0.0341 \end{aligned}$$

مثال(17): إذا علمت بأن معدل العمليات الجراحية بأحد الأقسام بمركز طرابلس الطبي 3 في اليوم , فأحسب احتمال وقوع الأحداث التالية:

1. عدم إجراء أي عملية جراحية في يوم معين.
2. إجراء عملية جراحية واحدة على الأقل في يوم معين.
3. إجراء عمليتين جراحيتين على الأكثر في يوم معين.
4. إجراء من 4 الي 6 عمليات جراحية خلال يومين.

الحل:

إذا كان المتغير العشوائي  $X$  يمثل عدد العمليات الجراحية في اليوم الواحد فإن هذا المتغير يتوزع وفق توزيع بواسون

بمعلمة  $\lambda = 3$  فإن:

$$P(X = x) = \begin{cases} \frac{e^{-\lambda} \lambda^x}{X!} & , X = 0, 1, 2, \dots \\ 0 & \text{خلاف ذلك} \end{cases}$$



وبالتالي يمكن الحصول على الاحتمالات المطلوبة باستخدام دالة كثافة الاحتمال لتوزيع بواسون أو باستخدام جدول توزيع بواسون رقم (3).

1. احتمال عدم إجراء أي عملية جراحية في يوم معين:  $P(X=0)$   
ومن جدول رقم (3) عندما  $\lambda = 3$  و  $X = 0$  نجد أن:  $P(X = 0) = 0.0498$
2. احتمال إجراء عملية جراحية واحدة على الأقل في يوم معين  $P(X \geq 1)$

وعليه فإن:

$$P(X \geq 1) = 1 - P(X = 0) = 1 - 0.0498 = 0.9502$$

3. احتمال إجراء عمليتين جراحيتين على الأكثر في يوم معين:  $P(X \leq 2)$   
وبالتالي فإن:

$$P(X \leq 2) = P(X = 0) + P(X = 1) + P(X = 2)$$

$$= 0.0489 + 0.1494 + 0.2240 = 0.4232$$

4. حيث أن معدل العمليات الجراحية في اليوم يساوي 3 فإن معدلها خلال يومين يساوي 6 أي أن:  
 $\lambda = 2 \times 3 = 6$

احتمال إجراء من 4 إلى 6 عمليات جراحية خلال يومين:

$$P(4 \leq X \leq 6)$$

وباستخدام جدول رقم (3) عندما  $\lambda = 6$  و  $X = 4, 5, 6$  نجد أن:

$$P(4 \leq X \leq 6) = P(X = 4) + P(X = 5) + P(X = 6)$$

$$= 0.1339 + 0.1606 + 0.1606 = 0.4551$$

## Appendix E

### The sample e-book used in this research (English)

#### English Translation

##### 5-2-9 The Poisson distribution

The distribution of this potentially be a model for many of the rare phenomena of random that happen , it is used in matters relating to the occurrence of phenomena in specific time periods where the time period may be a second , a minute , an hour , a day a week or a month ..... Etc. As used in matters relating to the occurrence of phenomena in specific areas, where the selected area may be a page from a book or square meters of area..... Etc. An example of this: the number of phone calls received by the switchboard in Faculty of Science during a specific time period , the number of car accidents that occur in a particular route through the day of the week , the number of goals during a match that record in basketball , the number of occurrences of lightning during a thunderstorm, the number of people who enter the post office every hour the number of typographical errors in the book contain many of the pages , the number of bacteria in the cells , the number of particles emitted from a radioactive substance during a certain period of time ..... Etc. In other words, this distribution is used to describe the behaviour of the rare events in the sense of events where the chance of success is very small event.

It is said that the X random variable Poisson distribution  $\lambda$  ( $0 < \lambda$ ) function block had a probability of the following:

$$P(X = x) = \begin{cases} \frac{e^{-\lambda}}{x!} & , x = 0, 1, 2, \dots \\ 0 & \text{Otherwise} \end{cases} \dots \dots \dots (33)$$

Other wise  $X \sim P(\lambda)$

And its symbol  $P(X = x) = 0$  that can proved  $\sum_{x=0}^{\infty} P(X = x) = 1$  by using the following mathematical information:

$$\sum_{x=0}^{\infty} \frac{a^x}{x!} = e^a$$

That **a** is truth number for this:

$$\sum_{x=0}^{\infty} P(X = x) = \sum_{x=0}^{\infty} \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=0}^{\infty} \frac{\lambda^x}{x!} = e^{-\lambda} e^{\lambda} = 1$$

Figure (7) shows the graphical representation of the probability mass function

$P(X = x)$ . It is clear from this that the distribution twisted to the right, remorse  $\lambda$  be small, and this is consistent with the nature of the random variable  $X$ , because the probability of failure of large and small probability of success.

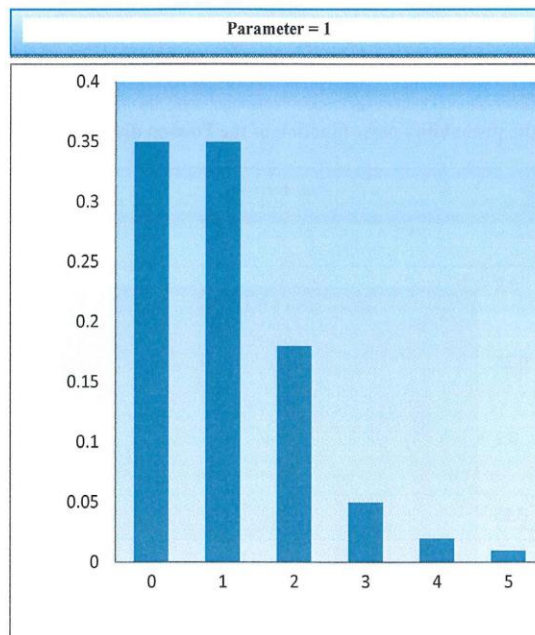


Figure (7-1) the probability mass function of the Poisson distribution when  $\lambda = 1$

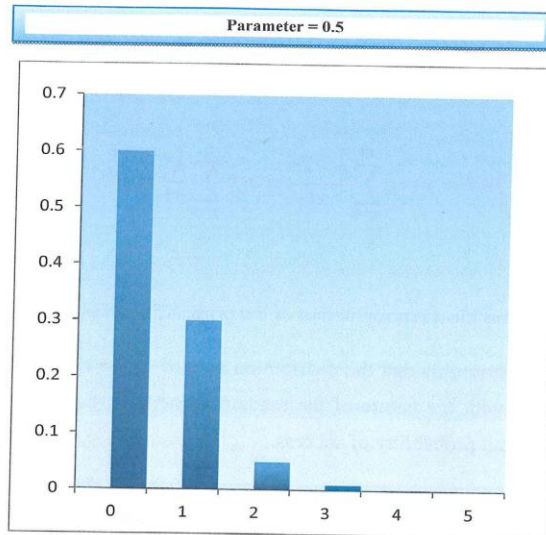


Figure (7-2) the probability mass function of the Poisson distribution when  $\lambda = 0.5$

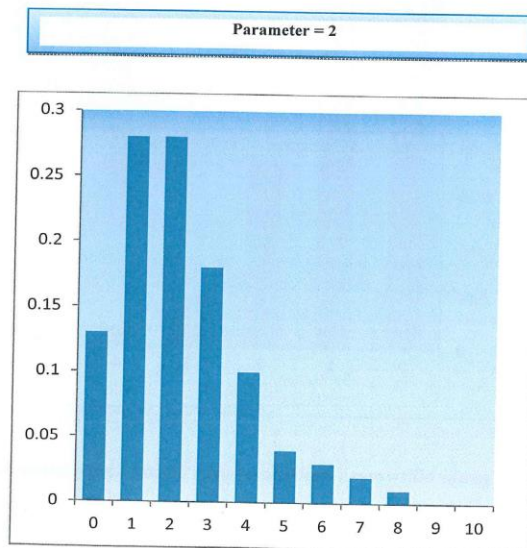


Figure (7-3) the probability mass function of the Poisson distribution when  $\lambda = 2$

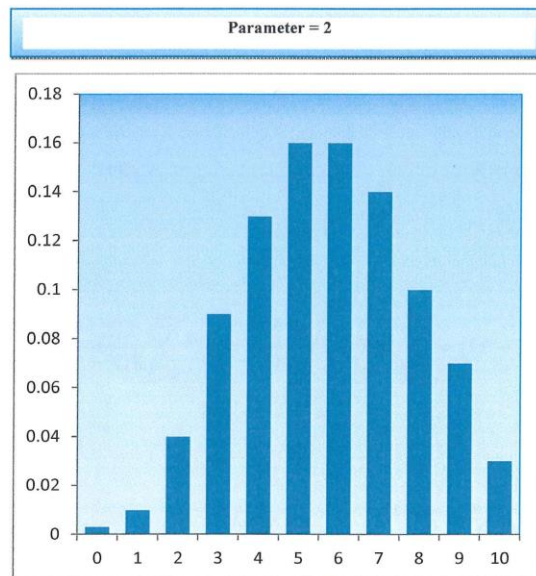


Figure (7-4) the probability mass function of the Poisson distribution when  $\lambda = 2$

**Theory (8):** If the random variable  $X$  is distributed according to the Poisson distribution parameter  $\lambda$  is:

$$\mu_X = E(X) = \lambda$$

$$\sigma_{X=V(X)}^2 = \lambda$$

$$m_X(t) = e^{\lambda(e^t - 1)}$$

**Proof:**

From the definition of the expected value, we find that

$$E(X) = \sum_{x=0}^{\infty} x \frac{e^{-\lambda} \lambda^x}{x!} = e^{-\lambda} \sum_{x=1}^{\infty} \frac{\lambda^x}{(x-1)!}$$

$$\begin{aligned}
&= \lambda e^{-\lambda} \sum_{y=0}^{\infty} \frac{\lambda^y}{y!}, \quad y = x - 1 \\
&= \lambda e^{-\lambda} e^{\lambda} = \lambda
\end{aligned}$$

So

$$\mu_{X=E(X)} = \lambda \dots \dots \dots (34)$$

$$\begin{aligned}
E[X(X-1)] &= \sum_{X=0}^{\infty} X(X-1) \frac{e^{-\lambda} \lambda^X}{X!} = e^{-\lambda} \sum_{X=2}^{\infty} \frac{X(X-1) \lambda^X}{X(X-1)(X-2)!} \\
&= e^{-\lambda} \lambda^2 \sum_{X=2}^{\infty} \frac{\lambda^{X-2}}{(X-2)!} = e^{-\lambda} \lambda^2 \sum_{y=0}^{\infty} \frac{\lambda^y}{y!}, \quad y = X - 2 \\
&= e^{-\lambda} \lambda^2 e^{\lambda} = \lambda^2
\end{aligned}$$

Thus:

$$E(X^2) = E[X(X-1)] + E(X) = \lambda^2 + \lambda$$

We find that

$$\sigma_X^2 = V(X) = E(X^2) - [E(X)]^2 = \lambda^2 + \lambda - \lambda^2 = \lambda \dots \dots \dots (35)$$

It definition of moment generating function that shows:

---


$$\begin{aligned}
 M_X(t) &= E(e^{tX}) = \sum_{X=0}^{\infty} e^{tX} \frac{e^{-\lambda} \lambda^X}{X!} = e^{-\lambda} \sum_{X=0}^{\infty} \frac{(\lambda e^t)^X}{X!} = e^{-\lambda} e^{\lambda e^t} \\
 &= e^{\lambda(e^t - 1)} = \exp.(\lambda(e^t - 1)) \dots \dots \dots (36)
 \end{aligned}$$

**Example (16):**

The cars that enumerate the accidents that occur in a particular week in the distribution of trace Poisson average of 0.7 equals what the probability of accidents, at least during one week?

**Solution:**

If the random variable **X** represents the number of accidents that occur in the week, the **X** is distributed according to the distribution of Poisson and hence the  $\lambda = 0.7$  that follow:

$$\begin{aligned}
 P(X \geq 3) &= \sum_{x=3}^{\infty} \frac{e^{-0.7} (0.7)^x}{X!} \\
 &= 1 - P(X < 3) = 1 - P(X \leq 2) \\
 &= 1 - \sum_{x=0}^2 \frac{e^{-0.7} (0.7)^x}{X!}
 \end{aligned}$$

$$= 1 - [0.4966 + 0.3476 + 0.1217] = 1 - 0.9659 = 0.0341$$

Luck that it is possible to obtain this probability distribution using a table odds Poisson in the last book , Table ( 3 ), when  $\lambda = 0.7$

$$P(X \geq 3) = 1 - P(X < 3)$$

$$= 1 - [P(X = 0) + P(X = 1) + P(X = 2)]$$

$$= 1 - [0.4966 + 0.3476 + 0.1217] = 0.0341$$

**Example (17):**

If he knew that the rate of surgical departments one of the Tripoli Medical Centre 3 day to calculate probability of the occurrence of the following event:

- 1- Not to carry out any operation on a particular day
- 2- Surgery and at least one on a given day
- 3- Conduct at least two surgeries on a given day
- 4- Hold from 4 to 6 surgeries in two days

**Solution:**

If the random variable X represents the number of surgeries per day , this variable is distributed according to the distribution of Poisson  $\lambda = 3$

$$P(X = x) = \begin{cases} \frac{e^{-\lambda} \lambda^x}{x!} & , X = 0, 1, 2, \dots \\ 0 & \text{Otherwise} \end{cases}$$

**Other wise**

Therefore can be obtained by using the possibilities the required function block probability distribution using a table or Poisson distribution No. (3).

- 1- May not conduct any operation on a particular day:  $p(X=0)$

From table NO. (3)  $\lambda = 3$  and  $X=0$  find :  $p(x=0) = 0.0498$

- 2- the possibility of surgery and at least one on a given day:  $p(1 \leq x)$

Thus

$$P(X \geq 1) = 1 - P(X = 0) = 1 - 0.0498 = 0.9502$$



3- The possibility of two surgeries on the most in a given day  $P(X \leq 2)$

$$\begin{aligned} P(X \leq 2) &= P(X = 0) + P(X = 1) + P(X = 2) \\ &= 0.0489 + 0.1494 + 0.2240 = 0.4232 \end{aligned}$$

4- Where the rate of surgical procedures per day equal to 3, the average during the two days equals 6 :

$$\lambda = 2 \times 3 = 6$$

5- The possibility of 4 to 6 surgeries in two days:

$$P(4 \leq X \leq 6)$$

Using Table (3), when  $X = 4, 5, 6$  و  $\lambda = 6$  :

$$\begin{aligned} P(4 \leq X \leq 6) &= P(X = 4) + P(X = 5) + P(X = 6) \\ &= 0.1339 + 0.1606 + 0.1606 = 0.4551 \end{aligned}$$

## Appendix F

### Student Guide 'Using Adobe Acrobat Pro' to read e-book

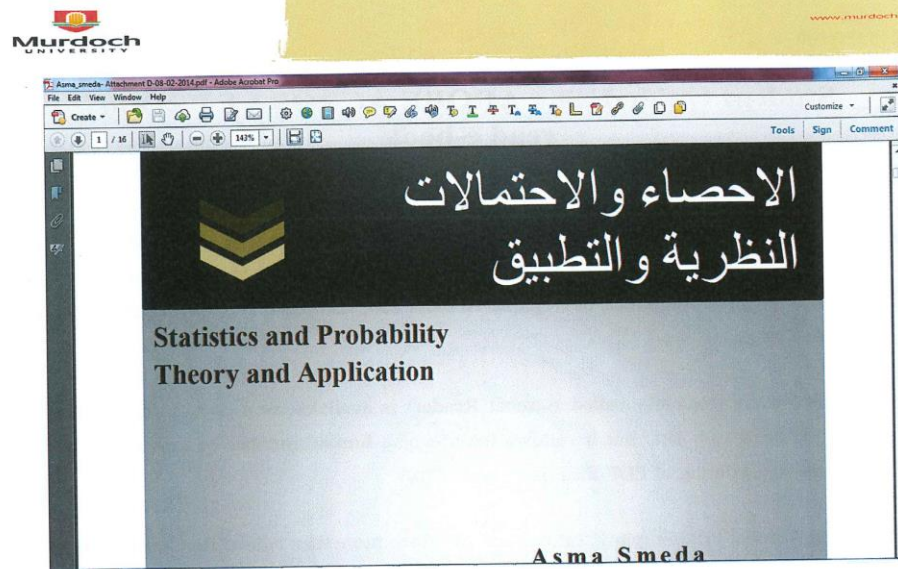


Figure (1)

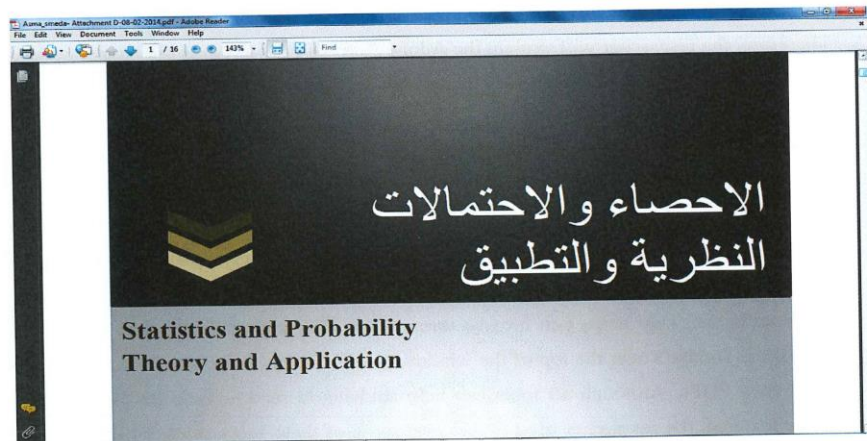


Figure (2)

## 1) Toolbars

The default toolbars—Quick Tools and Common Tools—contain commonly used tools and commands for working with PDFs. Most available tools are included in the Tools pane at the right side of the window. You can add tools to the toolbars for easy access.

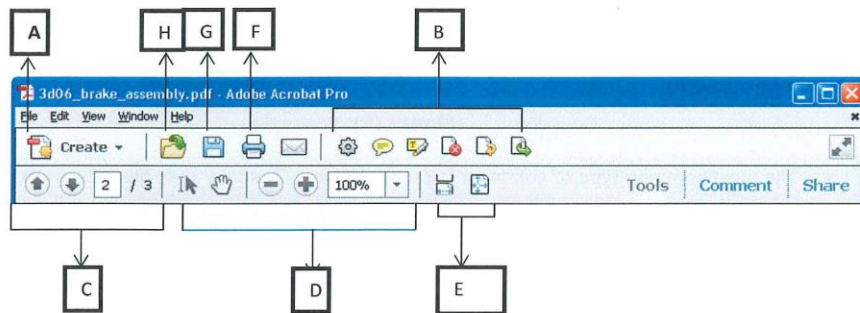


Figure (3)

### Create button

To create a new document, click on create, and choose pdf type.

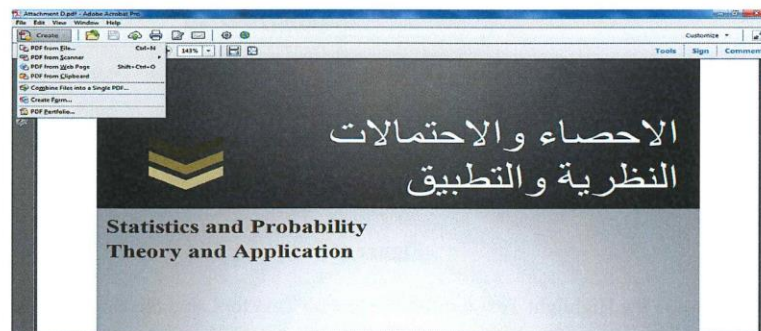



Figure (4)

### A. Quick Tools toolbar

- You can add tools you use frequently from the Tools and Comment panes to the Quick Tools toolbar, click the Customize Quick Tools button 

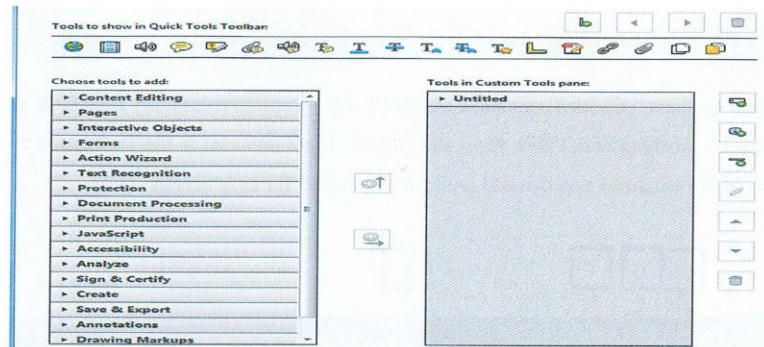



Figure (5)

- The most common type of comment is the sticky note. A sticky note has a note icon that appears on the page and a pop-up note for your text message. You can add a sticky note anywhere on the page or in the document area. First Select the Sticky Note tool  and the Annotations panel, and either click where you want to place the note or drag to create a custom-sized note.

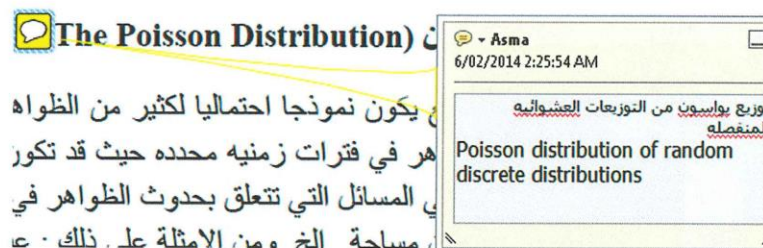


Figure (6)



- You can use the Highlight Text tool, Strikethrough Text tool, and the Underline Text tool to add comments by themselves or in conjunction with notes. You can add a highlight with a note or you can cross out text or underline text by selecting the text using the Select tool, right-clicking, and then choosing that option from the menu that appears. However, if you're marking up a lot of text, the specialized tools are faster and easier to use. Choose Comment > Annotations, and select the Highlight Text tool

 . The Strikethrough Text tool  , or the Underline Text tool .


## توزيع بواسون (The Poisson Distribution)

يقال إن للمتغير العشوائي  $X$  توزيع بواسون بمعلمة  $\lambda$  ( $\lambda > 0$ ) إذا كانت له دالة الكتلة الاحتمالية التالية



Figure (7)

- To insert any file, you should click 
- To save the rotation with the document, click the Rotate Page button  in the Quick Tools toolbar, or choose Tools > Pages > Rotate.

### B. Page Navigation commands

To navigate between pages 

### C. Select & Zoom commands

- Click the Zoom In button  or the Zoom Out button  in the toolbar.

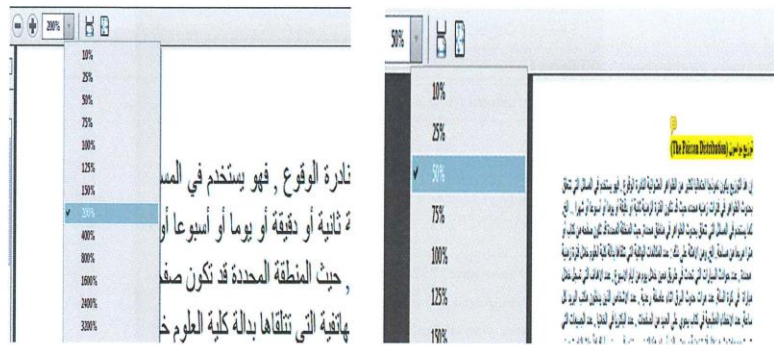




Figure (8)


- Enter a magnification percentage in the Common Tools toolbar, either by typing or choosing from the pop-up menu  118%

### D. Page Display commands


To control the view Page 




#### E. Print button

To print document click the print button  in the toolbar.

#### F. Save button

To save document click the save button  in the toolbar.

#### G. Open file

- Open a file from the Getting Started window. You can open a recent file or click the Open button  to locate a file.
- Choose File > Open, or click the Open File button in the toolbar. In the Open dialog box, select one or more filenames, and click Open. PDF documents usually have the extension .pdf.

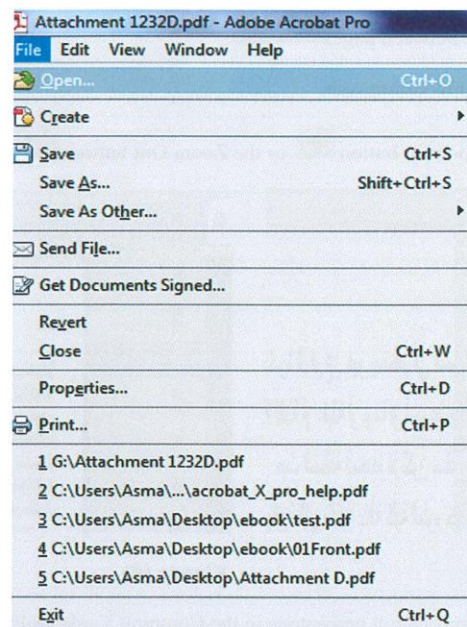

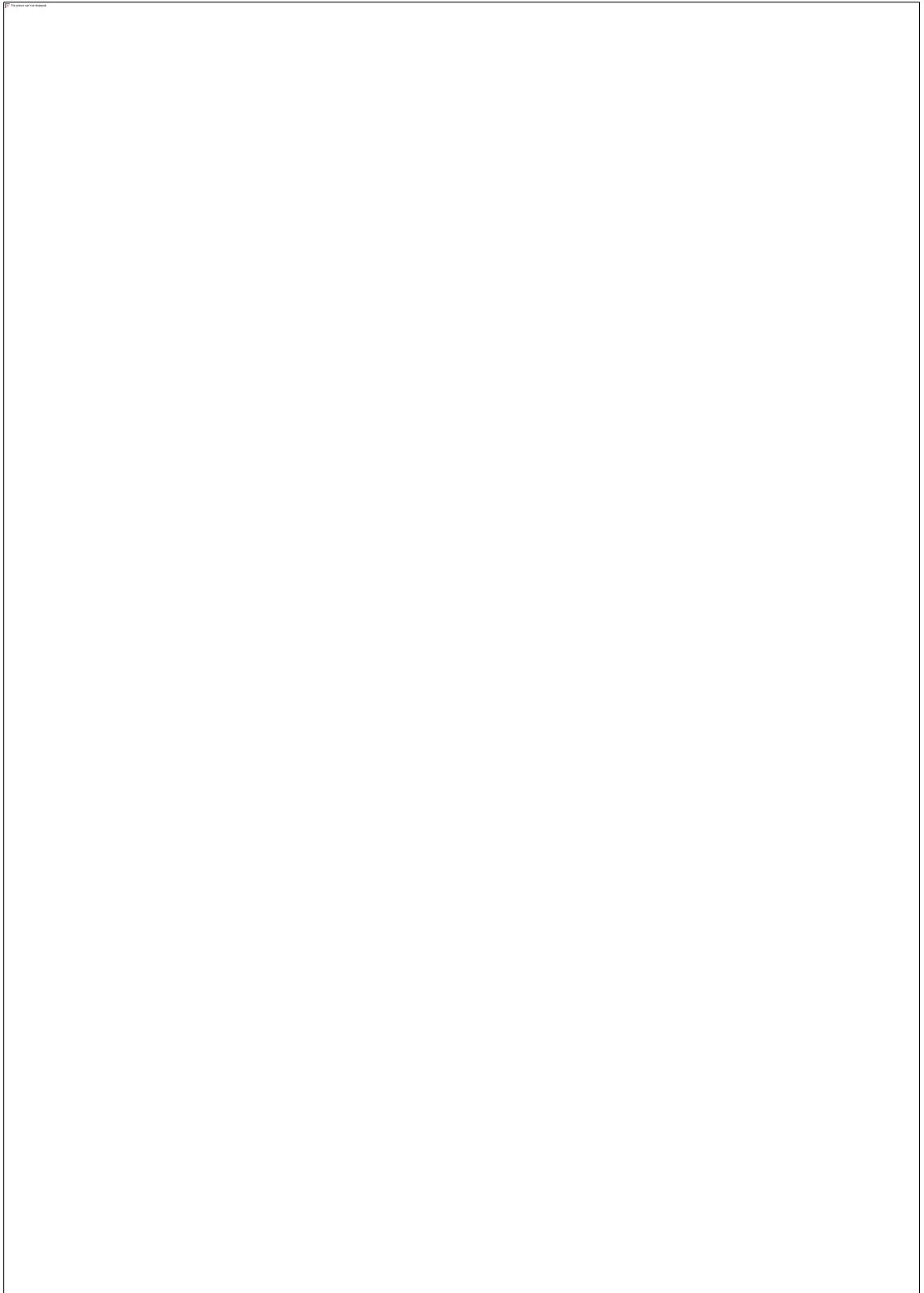


Figure (9)

2) You can add additional tools to the toolbars for easy access such as:

#### a) Add a pre-recorded audio comment

- Choose Comment > Annotations > Record Audio  and then click in the PDF where you want to place the audio comment.







- Click Browse (Windows) or Choose (Mac OS), and select the audio file you want to add.
- (Optional) To hear the audio comment, click the Play button . When you're finished, click Stop and then click OK.
- Specify options in the Properties dialog box, and then click OK.




Figure (10)

#### b) Record an audio comment

- Choose Comment > Annotations > Record Audio  and then click in the PDF where you want to place the audio comment.
- In the dialog box that appears, click the Record button  and then speak into the microphone. When you've finished recording, click the Stop button, and then click OK.
- Specify options  in the Properties dialog box, and then click OK.

#### c) Add comments in a file attachment

Use the Attach File tool to embed a file at a selected location in a PDF, so that the reader can open it for viewing. By adding attachments as a comment, you can reference longer documents that can't easily be pasted into a pop-up note or text box. If you move the PDF to a new location, the embedded file automatically goes with it. To view an attachment, the reader must have an application installed that can open the attachment.

- Choose Comment > Annotations > Attach File 
- Click in the PDF where you want to place the attachment.
- Select the file that you want to attach, and then click Select. If you're attaching a PDF, you can highlight areas of interest in the file using comments.
- In the File Attachment Properties dialog box, select the settings for the file icon that appears in the PDF.
- The comment attachment also appears in the Attachments tab with a page number indicating its location.



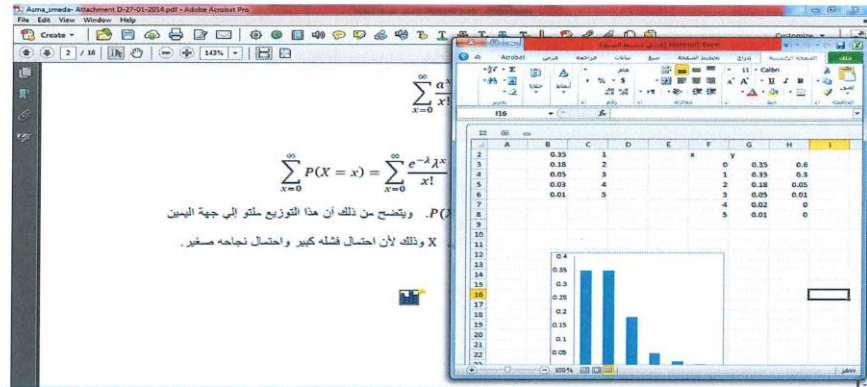






Figure (11)

d) Add a line, arrow, or shape

When selecting a drawing tool, consider the effect you want.

1. Choose Comment > Drawing Markups, and select a drawing tool:

- The Rectangle tool , the Oval tool , the Arrow tool , and the Line tool  let you create simple shapes.

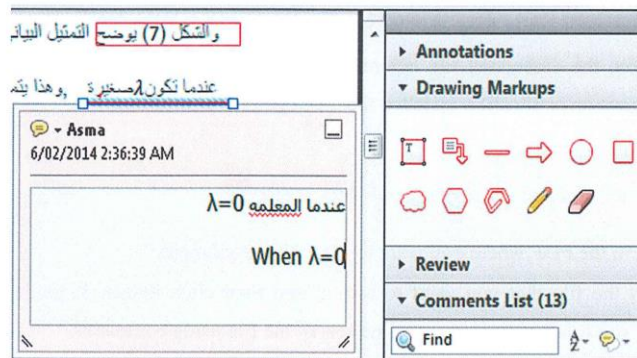




Figure (12)

- The Pencil tool , creates free-form drawings, and the Pencil Eraser tool  removes the pencil markups.

## Appendix G

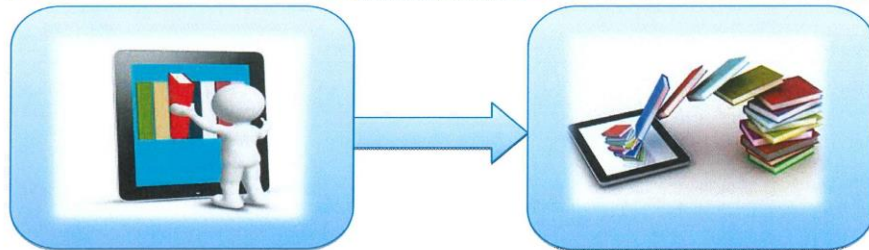
### The advertisement used to recruit participant



Attachment B

An Investigation of the Perception and Adoption of e-book amongst  
Mathematics and Statistics Students at Universities in Libya

The first steps towards the adoption of e-book in Libya...



What do you know about e-book?  
To find out more about e-book, we need you to participate in this survey

Interested to participate? Please contact:  
Asma Mohmead Smeda  
PhD Candidate  
School of Engineering and Information Technology  
Murdoch University, WA 6150 Australia  
EMAIL: [Asma\\_meda@yahoo.com](mailto:Asma_meda@yahoo.com)  
Mobile: +92 5678 786/ +92 372 3032  
Principle Supervisor: Dr. Mohd Fairuz Shiratuddin

CRICOS Provider Code: 00125J  
ABN 61 616 369 313

## Appendix H

### Letter of approval from Al-Gabel Al-Grbe University

	<b>ليبيا الحرة</b> وزارة التعليم العالي والبحث العلمي <b>جامعة الجبل الغربي</b> <b>الادارة العامة</b>	
التاريخ: / / الموافق: ٢٠١١ - ٢ - ١٤		رقم الملف: ٢٢٤٠٠٠٠٠ الرقم الاشاري: ١٥٣٦
<p>Dear Mrs. Asma Smeda</p> <p>First I would like to thank you for your interest to conduct your study in our university.</p> <p>Regarding to your litter to give you a permission to condut a research on Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at our University.</p> <p>We have no any objection that you join our university and our institutes to collect data helping in your study.</p> <p>Best regards,</p> <p>Dr. Mohamed M. Agnan Vice President of Scientific Affairs Tel: 00218927697463 Email: mohamedagnan@yahoo.com</p> <div style="text-align: right; margin-top: 20px;"> ٢/٢٠/١١</div> <div style="text-align: right; margin-top: 20px;"> </div>		
☎ 64418 ☎ 0242634833 ☎ 0242631949 - 0242503704		

## Appendix I

### Letter of approval from Al-Zawea University

Ministry Of Higher Education  
And Scientific Research

University OF Zawia

General Administration



وزارة التعليم العالي  
والبحث العلمي

جامعة الزاوية

الإدارة العامة

الرقم الإشاري: 8/736/ج

14 هـ

/ / الموافق:

20

4 / 4 / 7 التاريخ:

**Dear Mrs . Asma Smeda .**

First I would like to thank you for your interest to conduct your study in our university .

Regarding to your litter to give you a permission to condut a research on Investigation of the perception and Adoption of e-book amongst Mathematics and Statistics Students at our University .

We have no any objection that you join our university and our institutes to collect data helping in your study .

  
**Dr.Essam Eilbadri Abukhder**

**Vice president University of Zawia - Libya**





## Appendix J

### Letter of approval from Tripoli University

Ministry of Higher Education  
and Scientific Research  
University of Tripoli



دولة ليبيا  
وزارة التعليم العالي والبحث العلمي  
جامعة طرابلس  
مكتب رئيس الجامعة

التاريخ: / /  
الرقم الاشاري: .....

Dear Dr. M. Shiratuddin

Regarding your letter about seeking permission to conduct research on Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya, we have no objection if miss Asma Smeda would like to join University of Tripoli for collecting her data. Also, we will provide all the necessary facilities for her study.

Please, do not hesitate to contact if I can help.

Kind regards

Dr. Abdullatif S. Tubbal  
Director of International Co-operation Office (ICO)  
University of Tripoli  
Faculty of Sciences  
Department of Statistics  
Tripoli-Libya  
Tel: 00218214625301  
Fax: 00218214620325  
Mob: 00218926129867  
Email: abdtubbal@tripoliuniv.edu.ly



Tel: +218-21-4627910  
Fax: +218-21-4628839

هاتف: +218-21-4627910  
فاكس: +218-21-4628839

## Appendix K

### Approval letter from Research Ethics Office



Friday, 7 March 2014

Dr Mohd Fairuz Shiratuddin  
School of Engineering and Technology  
Murdoch University

Dear Fairuz,

**Project No.** 2014/028  
**Project Title** An Investigation of the Perception and Adoption of e-book amongst Mathematics and Statistics Students at Universities in Libya

Your application in support of the above project was reviewed by the Murdoch University Human Research Ethics Committee at a meeting held on 4<sup>th</sup> March 2014 and was;

#### APPROVED – subject to the following CONDITIONS:

- (a) Refer to Qn 6 on the Application Form. Provide a main contact person for the project. (NS 5.7.1)
- (b) Refer to Qn 28 (a) on the Application Form. Ensure data will be securely and accessibly stored at Murdoch University for at least five years.
- (c) Refer to the Permission Letter from Prof Ali Husein Ageli (Attachment N). The way this is written, grants permission for the use of any chapter in the book, but not necessarily the entire book. If more than a single chapter is to be utilised, ensure the arrangement is clarified. Also ensure that it is clear in the surveys and all material for this study which uses or refers to the e-book, that the authorship of the book is attributed to Prof Ali Husein Ageli, and not, even implicitly, to the student. (NS 2.2, 5.2)
- (d) More information is required on the staff recruitment and how this will be achieved. Please also provide a list of indicative questions if it is intended to interview staff. (NS 3.1)
- (e) Amend the Information Letter to: (NS 2.2.6)
  - Include the Research Ethics and Integrity Office's standard approval wording. See <http://our.murdoch.edu.au/Research-Ethics-and-Integrity/Human-research-ethics/Forms/> for the wording outline. (NS 2.2.6 (d))
  - If the contact details given for the student include a personal landline phone number, please alter this to a mobile or office number.
  - Proof read and revise for spelling errors, for example, amend "Principle" to "Principal".
  - Provide a separate Information Letter for students and staff.

#### Advice is provided that:

Refer to Qn 13 (a) and Qn 23 on the Application Form. Given the use of Yamane's sample size tables, the overall size of the participant population, as well as the recruitment strategy matters. The Yamane calculation assumes that the sample is a random sample. This study does not appear to utilise a random sample and therefore will likely lack the ability to generalise results to the broader student population. The recruitment of students in a genuinely random sample (and not merely a self-selected sample of volunteers) is critical to this calculation. The same issue, essentially, applies to the use of the Tabachnick and Fidel calculation. In this context consideration needs to be given to the principle that research participants must be asked to volunteer. It may be possible to utilise alternate calculations, or to recognise that the results will not be generalizable in any simple sense.

HREC Cond Approval Letter 140113

CRICOS Provider Code: 001253  
ABN 61 616 369 313

**You are not authorised to commence data collection** until all conditions listed have been addressed to the satisfaction of the Human Research Ethics Committee.

**Your response to the conditions should be forwarded in writing** to the Research Ethics Office. Once the committee is satisfied that the conditions have been met, you will be issued with a formal approval.

The committee expects researchers to respond to conditions in a timely manner. **If no response to conditions has been received within 4 months from the date of this letter, the conditional approval lapses** and a fresh application will be required.

Please quote your ethics project number in all correspondence.

Kind Regards,



Dr. Erich von Dietze  
Manager of Research Ethics

cc: Dr Kevin Wong and Asma Mohmead Smeda

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